PROGRAM & ABSTRACT

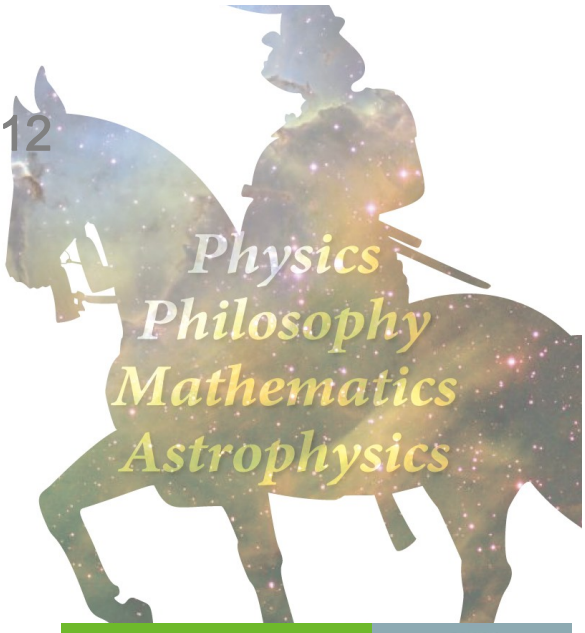
The 4th GCOE International Symposium

"Weaving Science Web beyond Particle-Matter Hierarchy"

物質階層を紡ぐ科学フロンティアの新展開

February 20 (Mon) - 22 (Wed), 2012

Main Lecture Hall, Faculty of Science
Aobayama Campus of Tohoku University,
Sendai, Japan



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Organizing committee

***(Chairman) Toshifumi Futamase, **(Program Leader) Kunio Inoue**

Organizing Committee (Extended steering committee of GCOE program):

- **Toshifumi Futamase** (Astrophysics Tohoku Univ.)*
- **Osamu Hashimoto** (Nuclear Physics, Tohoku Univ.)
- **Ken-ichi Hikasa** (Particle Physics, Tohoku Univ.)
- **Yoshiro Hirayama** (Condensed Matter Physics, Tohoku Univ.)
- **Kunio Inoue** (Particle Physics, Tohoku Univ.)**
- **Motoko Kotani** (Mathematics, Tohoku Univ.)
- **Hideo Kozono** (Mathematics, Tohoku Univ.)
- **Yoshio Kuramoto** (Condensed Matter Physics, Tohoku Univ.)
- **Kiyotaka Naoe** (Philosophy, Tohoku Univ.)
- **Takashi Takahasi** (Condenced Matter Physics, Tohoku Univ.)
- **Hirokazu Tamura** (Nuclear Physics, Tohoku Univ.)
- **Masahiro Yamaguchi** (Particle Physics, Tohoku Univ.)

Local Committee:

- **Toshifumi Futamase** (Astrohysics, Tohoku Univ.) *
- **Tsuguhiko Asakawa** (Particle Physics, Tohoku Univ.)
- **Satoshi Heguri** (Condensed Matter Physics, Tohoku Univ.)
- **Takeshi Koike** (Nuclear Physics, Tohoku Univ.)
- **Shumpei Masuda** (Condensed Matter Physics, Tohoku Univ.)
- **Joji Nasu** (Condensed Matter Physics, Tohoku Univ.)
- **Mariko Nihei** (Philosophy, Tohoku Univ.)
- **Daisuke Nitta** (Astrophysics, Tohoku Univ.)
- **Takahiro Okabe** (Mathematics, Tohoku Univ.)
- **Mamoru Tanaka** (Mathematics, Tohoku Univ.)
- **Mikito Tanaka** (Astrophysics, Tohoku Univ.)
- **Takato Uehara** (Mathematics, Tohoku Univ.)

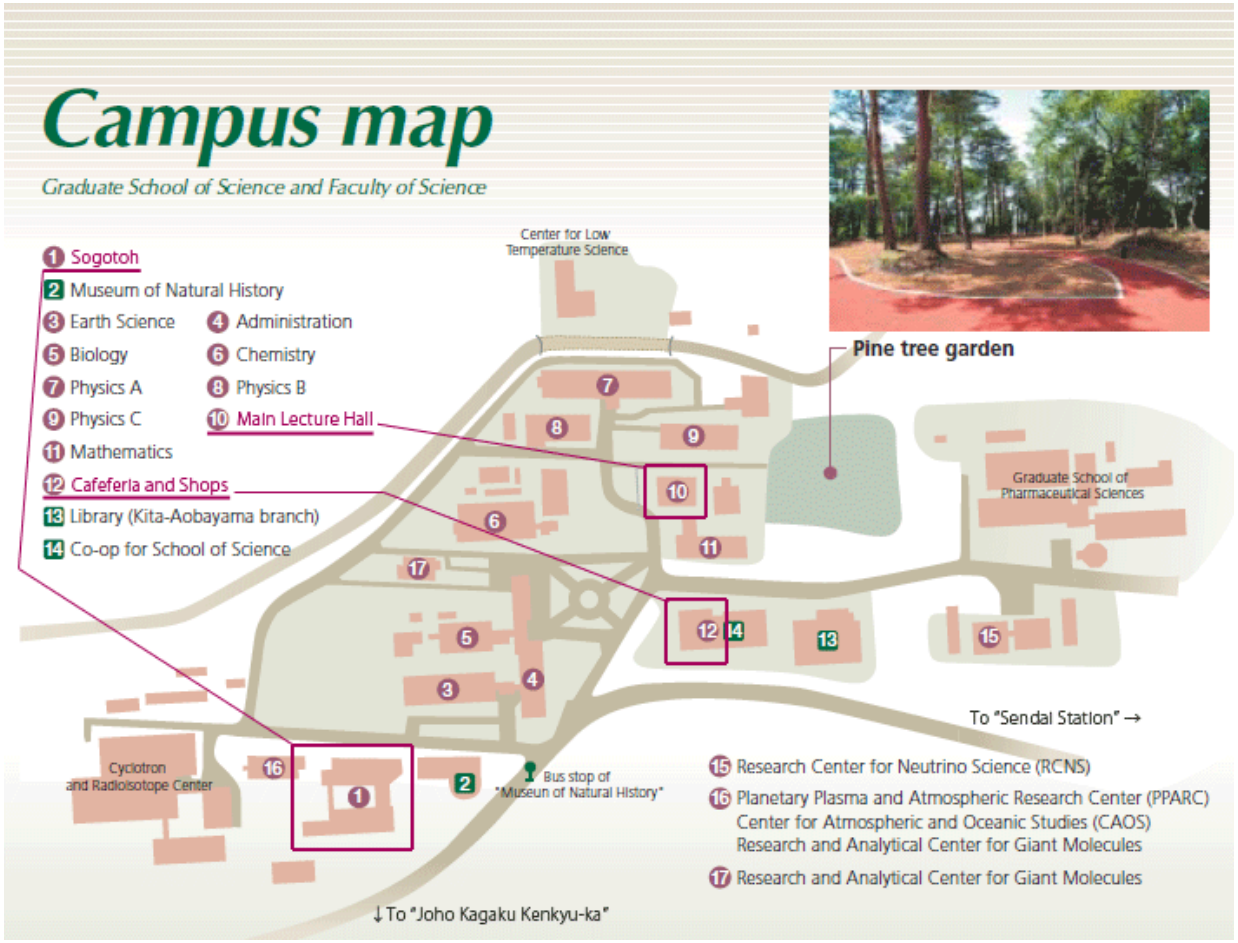
GCOE program members

Name	*Affiliated Department, Position Title/Specialized field*
Representative	
Akihisa Inoue	President of Tohoku University
Program Leader	
Kunio Inoue	Research Center for Neutrino Science, Professor/Neutrino Experiment
Program Members	
Ken-ichi Hikasa	Graduate School of Science, Professor/Particle Theory
Osamu Hashimoto	Graduate School of Science, Professor/Nuclear Experiment
Yoshio Kuramoto	Graduate School of Science, Professor/Condensed Matter Theory
Yoshiro Hirayama	Graduate School of Science, Professor/Quantum Semiconductor Physics
Hirokazu Tamura	Graduate School of Science, Professor/Nuclear Experiment
Masahiro Yamaguchi	Graduate School of Science, Professor/Particle Theory
Riichiro Saito	Graduate School of Science, Professor/Condensed Matter Theory
Hitoshi Yamamoto	Graduate School of Science, Professor/Particle Experiment
Toshihiro Kawakatsu	Graduate School of Science, Professor/Condensed Matter Theory
Teruya Ishihara	Graduate School of Science, Professor/Solid state Photo physics
Toshio Kobayashi	Graduate School of Science, Professor/Nuclear Experiment
Hajime Shimizu	Research Center for Electron Photon Science, Professor/Nuclear Experiment

Yasuhiro Sakemi	Cyclotron and Radioisotope Center, Professor/Nuclear Experiment
Kazuyoshi Yamada	WPI and Department of Physics, Professor/Condensed Spin Matter Physics
Takashi Takahashi	WPI and Department of Physics, Professor/Photoemission Solid-State Physics
Katsumi Tanigaki	WPI and Department of Physics, Professor/Solid State Physics on Nano-Network Solids
Hideo Kozono	Graduate School of Science, Professor/Mathematical Physics
Motoko Kotani	Graduate School of Science, Professor/Differential Geometry
Reiko Miyaoka	Graduate School of Science, Professor/Differential Geometry
Takashi Shioya	Graduate School of Science, Professor/Riemannian Geometry
Takayoshi Ogawa	Graduate School of Science, Professor/Partial Differential Equations
Kazuhiro Ishige	Graduate School of Science, Professor/Partial Differential Equations
Toshifumi Futamase	Graduate School of Science, Professor/Cosmology and General Relativity
Takashi Ichikawa	Graduate School of Science, Professor/Extragalactic Astronomy
Toru Yamada	Graduate School of Science, Professor/Extragalactic Astronomy
Makoto Hattori	Graduate School of Science, Associate Professor/Observational Cosmology
Keiichi Noe	Graduate School of Arts and Letters, Professor/Science Philosophy
Kiyotaka Naoe	Graduate School of Arts and Letters, Associate Professor/Ethics of Science and Technology

Symposium Location

Aobayama Campus of Faculty of Science, Tohoku University



Registration: Main Lecture Hall (Feb.20-21, 08:30-12:30)
"Sogotoh" Bldg. 2F(Feb.20-21, 13:30-17:00)

Plenary Session: Main Lecture Hall (Feb.20-22, 9:00-13:00)

Parallel Sessions: Rooms, 203, 204, and 303, "Sogotoh" Bldg.
(Feb.20-21, 14:00-17:00)

Poster Session: Entrance Hall (2F) & Room 205, "Sogotoh" Bldg.
(Feb.20-21, 17:00-18:00)

Banquet: Campus Cafeteria (Feb. 20, 18:30-20:00)

Scientific Program

http://www.scienceweb.tohoku.ac.jp/special/gcoeis2012/

Invited speakers

Plenary session:

Hayato Chiba (Mathematics / Assistant Prof., Institute of Mathematics for Industry, Kyushu University, Japan) "

Yoshinori Imai (Condensed Matter Physics / Assistant Prof., University of Tokyo, Japan)

Kunio Inoue (Particle Physics-Neutrino / Professor, Research Center for Neutrino Science - RCNS, Tohoku University, Japan)

Masahiro Kawasaki (Particle Cosmology / Professor**,** Institute for Cosmic Ray Research - ICRR, University of Tokyo, Japan)

Andreas Kluemper (Condensed Matter Physics / Professor, University of Wuppertal, Germany)

Peter Kroes (Philosophy / Professor, Delft University of Technology, Holland)

Yasunori Maekawa (Mathematics / Associate Prof., Kobe University, Japan)

Hans-Josef Schulze (Nuclear Physics / Prof., INFN - University of Catania, Italy)

Peter Schupp (Particle Physics / Professor, School of Engineering & Science, Jacobs Univ., Germany)

Howard Smith (Astrophysics / Professor, Harvard-Smithsonian Center for Astrophysics - CfA, USA)

Kazuhiro Yamamoto (Astrophysics / Associate Prof., Hiroshima University, Japan)

Parallel session:

Patrick Achenbach (Nuclear Physics / Dr., Institute of Nuclear Physics, Joh. Gutenberg University, Germany)

Shigeyuki Aoki (Philosophy / Associate Prof., University of Aizu, Japan)

Mireya Etxaluze Azkonaga (Astrophysics / Dr., Centro de Astrobiologia, Instituto Nacional de Técnica Aeroespacial (CSIC/INTA), Spain)

Michael Brockmann (Condensed Matter Physics / Doctoral student, University of Wuppertal, Germany)

Luca del Frate (Philosophy / Doctoral student, Delft University of Technology, Holland)

Tomohiro Fukaya (Mathematics, Dr., Kyoto University, Japan)

Hisataka Furuta (Particle Physics / Dr., Tohoku University, Japan)

Masatoshi Itoh (Nuclear Physics / Assistant Prof., CYRIC, Tohoku University, Japan)

Lauranne Lanz (Astrophysics / Doctoral student, Harvard-Smithsonian Center for Astrophysics - CfA, USA)

Sachiko Maki (Condensed Matter Physics / Doctoral student, Nagoya University, Japan)

Hiroaki Matsueda (Condensed Matter Physics / Associate Prof., Sendai National College of Technology, Japan)

Matsuo Sato (Particle Physics / Associate Prof., Hirosaki University, Japan)

GCOE Assistant Professors, Tohoku University

Tsuguhiko Asakawa (Particle Physics / Assistant Prof., Tohoku University, Japan)

Satoshi Heguri (Condensed Matter Physics / Assistant Prof., Tohoku University, Japan)

Takeshi Koike (Nuclear Physics / Assistant Prof., Tohoku University, Japan)

Shumpei Masuda (Condensed Matter Physics / Assistant Prof., Tohoku University, Japan)

Joji Nasu (Condensed Matter Physics / Assistant Prof., Tohoku University, Japan)

Daisuke Nitta (Astrophysics / Assistant Prof., Tohoku University, Japan)

Takahiro Okabe (Mathematics / Assistant Prof., Tohoku University, Japan)

Mamoru Tanaka (Mathematics / Assistant Prof., Tohoku University, Japan))

Mikito Tanaka (Astrophysics / Assistant Prof., Tohoku University, Japan)

Takato Uehara (Mathematics / Assistant Prof., Tohoku University, Japan)

Time Table

February 20 Monday 2012			
Plenary Session Main Lecture Hall			
9:00 ~ 9:10	***"Opening"*** **Kunio INOUE** (GCOE Project Leader)		
9:10 ~ 9:55	(Particle Physics) **Peter Schupp** (Prof., Jacobs University Bremen, Germany)		
9:55 ~ 10:40	(Condensed Matter Physics) **Yoshinori Imai** (Prof., University of Tokyo, Japan)		
10:40 ~ 11:00	*Coffee Break*		
11:00 ~ 11:45	(Astrophysics) **Howard Smith** (Prof. , Harvard-Smithsonian Center for Astrophysics - CfA, USA)		
11:45 ~ 12:30	(Mathematics) **Hayato Chiba** (Assistant Prof.**,** Institute of Mathematics for Industry, Kyushu University, Japan)		
12:30 ~ 14:00	*Lunch*		
Parallel Session A, B, C **Lecture rooms 203, 204, 303**			
	A (Room 203)	**B (Room 204)**	**C (Room 303)**
14:00 ~14:35	(Condensed Matter Physics) **Michael Brockmann** (PhD student, University of Wuppertal, Germany)	(Particle Physics) **Matsuo Sato** (Hirosaki University, Japan)	(Nuclear Physics) **Patrick Achenbach** (Dr., Joh. Gutenberg University, Germany)
14:35 ~15:10	(Condensed Matter Physics) **Joji Nasu** (Assistant Prof**.**, Tohoku University, Japan)	(Particle Physics) **Hisataka Furuta** (Dr., Tohoku University, Japan)	(Nuclear Physics) **Masatoshi Itoh** (Assistant Prof., Tohoku University, Japan)
15:10 ~15:30	*Coffee Break*		
15:30 ~16:05	(Condensed Matter Physics) **Sachiko Maki** (PhD student, Nagoya University, Japan)	(Particle Physics) **Tsuguhiko Asakawa** (Assistant Prof., Dept. of Physics, Tohoku University)	(Nuclear Physics) **Takeshi Koike** (Assistant Prof., Tohoku University, Japan)
16:05 ~16:40	(Condensed Matter Physics) **Shumpei Masuda** (Assistant Prof**.**, Tohoku University, Japan)		
Poster Session Entrance hall 2F & Room 205			
16:40 ~18:00	Entrance hall 2F & Room 205: Posters exhibited: "odd" numbers on the poster presentation list		
18:20 ~20:00	*Banquet at Campus Cafeteria*		

February 21 Tuesday 2012			
Plenary Session Main Lecture Hall			
9:00 ~ 9:45	(Nuclear Physics) **Hans-Josef Schulze** (Prof., INFN - University of Catania, Italy)		
9:45 ~ 10:30	(Condensed Matter Physics) **Andreas Kluemper** (Prof., University of Wuppertal, Germany)		
10:30 ~ 10:50	*Coffee Break*		
10:50 ~ 11:35	(Astrophysics) **Kazuhiro Yamamoto** (Associate Prof., Hiroshima University, Japan)		
11:35 ~ 12:20	(Mathematics) **Yasunori Maekawa** (Associate Prof., Kobe University, Japan)		
12:20 ~ 13:05	(Philosophy) **Peter Kroes** (Prof., Delft University of Technology, Holland)		
13:05 ~ 14:30	*Lunch*		
Parallel Session A, B **Lecture rooms 203, 204, 303**			
	A (Room 203)	**B (Room 204)**	**C (Room 303)**
14:30 ~ 15:05	(Condensed Matter Physics) **Hiroaki Matsueda** (Associate Prof., Sendai National College of Technology, Japan)	(Astrophysics) **Mireya Etxaluze Azkonaga** (Dr., CSIC/INTA, Spain)	(Mathematics) **Tomohiro Fukaya** (Dr., Kyoto University, Japan)
15:05 ~ 15:40	(Condensed Matter Physics) **Satoshi Heguri** (Assistant Prof. Tohoku University, Japan)	(Astrophysics) **Daisuke Nitta** (Assistant Prof. Tohoku University, Japan)	(Mathematics) **Takato Uehara** (Assistant Prof. Tohoku University, Japan)
15:40 ~ 15:50	*Coffee Break*		
15:50 ~ 16:25	(Philosophy) **Shigeyuki Aoki** (Associate Prof., University of Aizu, Japan)	(Astrophysics) **Lauranne Lanz** (PhD student, CfA, USA)	(Mathematics) **Takahiro Okabe** (Assistant Prof., Tohoku University, Japan)
16:25 ~ 17:00	(Philosophy) **Luca del Frate** (PhD student, Delft University of Technology, Holland)	(Astrophysics) **Mikito Tanaka** (Assistant Prof. Tohoku University, Japan)	(Mathematics) **Mamoru Tanaka** (Assistant Prof. Tohoku University, Japan)
Poster Session Entrance hall 2F & Room 205			
17:00 ~ 18:20	Entrance hall 2F & Room 205: Posters exhibited: "even" numbers on the poster presentation list		

February 22 Wednesday 2012	
Plenary Session Main Lecture Hall	
9:00 ~ 9:45	(Particle Cosmology) **Masahiro Kawasaki** (Prof., Institute for Cosmic Ray Research, University of Tokyo, Japan)
9:45~ 10:30	(Neutrino Physics) **Kunio Inoue** (Prof., Research Center for Neutrino Science , Tohoku University, Japan)
10:30 ~ 10:40	*"Closing"* **Toshifumi Futamase** (Chairman of Organizing Committee)

Speakers/Titles

February 20 Monday

Plenary Session – Particle-, Condensed Matter-Physics, Astrophysics, Mathematics

Main Lecture Hall

09:00 – 09:10	***(Chairman) T. Futamase*** **Kunio INOUE (GCOE program leader)** – "Opening address"
09:10 – 09:55	***(Chairman) M. Yamaguchi*** **Peter Schupp** (Particle Physics / Professor., Jacobs University Bremen, Germany) "Space-time quantum geometry"
09:55 – 10:40	***(Chairman) K. Tanigaki*** **Yoshinori Imai** (Condensed Matter Physics / Assistant Prof. University of Tokyo, Japan) "Dynamics of superfluids and quasiparticles in iron-based superconductors investigated by microwave to terahertz conductivity measurements"
10:40 – 11:00	***Coffee Break***
11:00 – 11:45	***(Chairman) M. Hattori*** **Howard Smith** (Astrophysics / Professor., Harvard-Smithsonian Center for Astrophysics - CfA, USA) "Star Formation Near and Far: Recent Smithsonian Infrared-Submillimer Research"
11:45 – 12:30	***(Chairman) T. Shioya*** **Hayato Chiba** (Mathematics / Assistant Prof., Institute of Mathematics for Industry, Kyushu University, Japan) "Synchronization - A bifurcation theory of infinite dimensional dynamical systems –"
12:30 – 14:00	*Lunch*

Parallel Session A– Condensed Matter Physics

Room203

14:00 – 14:35	***(Chairman) S. Masuda*** **Michael Brockmann** (Condensed Matter Physics / Doctoral student, University of Wuppertal, Germany) "Mircrowave Absorption by Anti-Ferromagnetic Spin Chains"
14:35 – 15:10	**Joji Nasu** (Condensed Matter Physics / Assistant Prof., Tohoku University, Japan) "Dynamical Jahn-Teller Effect in Spin-Orbital Coupled System"
15:10 – 15:30	*Coffee Break*
15:30 – 16:05	***(Chairman) S. Heguri*** **Sachiko Maki** (Condensed Matter Physics / Doctoral student, Nagoya University, Japan) "Structural Study on Quasi One-dimensional Organic Conductor, $(TMTTF)_2PF_6$ by Synchrotron X-ray Diffraction"
16:05 – 16:40	**Shumpei Masuda** (Condensed Matter Physics / Assistant Prof., Tohoku University, Japan) "Interference effects of helical current of two dimensional topological insulator"

Parallel Session B – Particle Physics	Room204
	(Chairman) T. Asakawa
14:00 – 14:35	**Matsuo Sato** (Particle Physics / Associate Prof., Hirosaki University, Japan) "3-algebra Model of M-theory"
14:35 – 15:10	**Hisataka Furuta** (Particle Physics / Dr., Tohoku University, Japan) "Double Chooz experiment – A search for neutrino mixing angle θ_{13}"
15:10 – 15:30	*Coffee Break*
	(Chairman) Mastuo Sato
15:30 – 16:05	**Tsuguhiko Asakawa** (Particle Physics / Assistant Prof., Tohoku University, Japan) "Noncommutative Solitons of Gravity"
16:05 – 16:40	

Parallel Session C –Nuclear Physics	Room303
	(Chairman) T. Koike
14:00 – 14:35	**Patrick Achenbach** (Nuclear Physics / Dr., Institute of Nuclear Physics, Joh. Gutenberg University, Germany) "High-precision form factor measurements at MAMI"
14:35 – 15:10	**Masatoshi Itoh** (Nuclear Physics / Assistant Prof., CYRIC, Tohoku University, Japan) "The 2^+ excitation of the Hoyle state in ^{12}C"
15:10 – 15:30	*Coffee Break*
	(Chairman) Hans-Josef Schulze
15:30 – 16:05	**Takeshi Koike** (Nuclear Physics / Assistant Prof., Tohoku University, Japan) "γ -ray spectroscopy of *sd*-shell hypernuclei at J-PARC"
16:05 – 16:40	

Poster Session	Entrance-hall 2F and Room205
16:40 – 18:00	**Entrance-hall 2F: Exhibit = odd number of Poster no. 1~31** **Room 205 : Exhibit = odd number of Poster no. 33~85**
18:20 – 20:00	***Banquet* at Campus Cafeteria**

February 21 Tuesday

Plenary Session – Nuclear -, Condensed Matter-Physics, Astrophysics, Mathematics, Philosophy

Main Lecture Hall

09:00 -09:45	***(Chairman) H. Tamura*** **Hans-Josef Schulze** (Nuclear Physics / Professor., INFN - University of Catania, Italy) "Neutron stars with hyperons and quarks"
09:45 – 10:30	***(Chairman) Y. Kuramoto*** **Andreas Kluemper** (Condensed Matter Physics / Professor., University of Wuppertal, Germany) "Exact results for many body systems by use of the Yang-Baxter equation and related algebraic structures"
10:30 – 10:50	*Coffee Break*
10:50 – 11:35	***(Chairman) T. Futamase*** **Kazuhiro Yamamoto** (Astrophysics / Associate Prof., Hiroshima University, Japan) "Accelerating expansion of the universe and testing gravity on cosmological scale"
11:35 – 12:20	***(Chairman) H. Kozono*** **Yasunori Maekawa** (Mathematics / Associate Prof., Kobe University, Japan) "On vorticity formulation for viscous incompressible flows in the half plane and its application to the inviscid limit problem"
12:20 – 13:05	***(Chairman) K. Naoe*** **Peter Kroes** (Philosophy / Professor, Delft University of Technology, Holland) "The creation of physical phenomena and of technical artefacts"
13:05 – 14:30	*Lunch*

Parallel Session A – Condensed Matter Physics / Philosophy

Room203

14:30 – 15:05	***(Chairman) J. Nasu*** **Hiroaki Matsueda** (Condensed Matter Physics / Associate Prof., Sendai National College of Technology, Japan) "AdS/CFT correspondence in statistical and information physics"
15:05 – 15:40	**Satoshi Heguri** (Condensed Matter Physics / Assistant Prof., Tohoku University, Japan) "Vibrations of guest atoms induced anomalous physical properties in type-1 clathrate"
15:40 – 15:50	*Coffee Break*
15:50 – 16:25	***(Chairman) M. Nihei*** **Shigeyuki Aoki** (Philosophy / Associate Prof., University of Aizu, Japan) "Philosophy of Science Useful for Scientists?"
16:25 – 17:00	**Luca del Frate** (Philosophy / Doctoral student, Delft University of Technology, Holland) "Failure of engineering artefacts: a life cycle approach"

Parallel Session B – Astrophysics	Room204
	(Chairman) Mikito Tanaka
14:30 – 15:05	**Mireya Etxaluze Azkonaga** (Astrophysics / Dr., Centro de Astrobiologia, Instituto Nacional de Técnica Aeroespacial (CSIC/INTA) Spain) "Herschel/SPIRE FTS observations of the Sagittarius B2 molecular cloud"
15:05 – 15:40	**Daisuke Nitta** (Astrophysics / Assistant Prof., Tohoku University, Japan) "Shadows of multi-black holes in de Sitter space-time"
15:40 – 15:50	***Coffee Break***
	(Chairman) D. Nitta
15:50 – 16:25	**Lauranne Lanz (**Astrophysics / Doctoral student, Harvard-Smithsonian Center for Astrophysics - CfA, USA) "Investigating Galaxy Interactions from the Ultraviolet to the Far-Infrared"
16:25 – 17:00	**Mikito Tanaka** (Astrophysics / Assistant Prof., Tohoku University, Japan) "Galactic Archaeology - Observational Studies of the Stellar Halo of the Andromeda Galaxy using Subaru telescope"

Parallel Session C – Mathematics	Room303
	(Chairman) Mamoru Tanaka
14:30 – 15:05	**Tomohiro Fukaya** (Mathematics / Dr., Kyoto University, Japan) "Coarse Baum-Connes conjecture for relatively hyperbolic groups"
15:05 – 15:40	**Takato Uehara** (Mathematics /Assistant Prof., Tohoku University, Japan) "Ergodic Theory of Painlevé VI"
15:40 – 15:50	***Coffee Break***
	(Chairman) T. Uehara
15:50 – 16:25	**Takahiro Okabe** (Mathematics / Assistant Prof., Tohoku University, Japan) "Initial profile for the slow decay of the Navier-Stokes flow in the half-space"
16:25 – 17:00	**Mamoru Tanaka** (Mathematics / Assistant Prof., Tohoku University, Japan) "Higher eigenvalues of the Laplacian on a graph and partitions of the graph"

Poster Session	Entrance-hall 2F and Room205
17:00 – 18:20	**Entrance-hall 2F: Exhibit = even number of Poster no. 2~32** **Room 205: Exhibit = even number of Poster no. 34~86**

February 22 Wednesday

Plenary Session –Particle Cosmology, Particle Physics,
Main Lecture Hall

(Chairman) K. Hikasa

09:00 -09:45	**Masahiro Kawasaki** (Particle Cosmology / Professor, Institute for Cosmic Ray Research - ICRR, University of Tokyo, Japan) "Axion Cosmology"
09:45 – 10:30	**Kunio Inoue** (Neutrino Physics / Professor, Research Center for Neutrino Science - RCNS, Tohoku University, Japan) "Can matter-particle and antimatter-particle be the same? -- Neutrino-less double beta decay search with KamLAND: KamLAND-Zen --"
10:30 – 10:40	**Toshifumi Futamase (Chairman of Organizing Committee)** – "Closing address"

Talks

Plenary Session

Feb 20 2012

Talk-01 **Peter Schupp** (Particle Physics / Professor, Jacobs University Bremen, Germany)
"Space-time quantum geometry"

Talk-02 **Yoshinori Imai** (Condensed Matter Physics / Assistant Prof. University of Tokyo, Japan)
"Dynamics of superfluids and quasiparticles in iron-based superconductors investigated by microwave to terahertz conductivity measurements"

Talk-03 **Howard Smith** (Astrophysics / Professor, Harvard-Smithsonian Center for Astrophysics - CfA, USA)
"Star Formation Near and Far: Recent Smithsonian Infrared-Submillimer Research"

Talk-04 **Hayato Chiba** (Mathematics / Assistant Prof., Institute of Mathematics for Industry, Kyushu University, Japan)
"Synchronization - A bifurcation theory of infinite dimensional dynamical systems –"

Feb 21 2012

Talk-05 **Hans-Josef Schulze** (Nuclear Physics / Prof., INFN - University of Catania, Italy)
"Neutron stars with hyperons and quarks"

Talk-06 **Andreas Kluemper** (Condensed Matter Physics / Professor, University of Wuppertal, Germany)
"Exact results for many body systems by use of the Yang-Baxter equation and related algebraic structures"

Talk-07 **Kazuhiro Yamamoto** (Astrophysics / Associate Prof., Hiroshima University, Japan)
"Accelerating expansion of the universe and testing gravity on cosmological scales"

Talk-08 **Yasunori Maekawa** (Mathematics / Associate Prof., Kobe University, Japan)
"On vorticity formulation for viscous incompressible flows in the half plane and its application to the inviscid limit problem"

Talk-09 **Peter Kroes** (Philosophy / Professor, Delft University of Technology, Holland)
"The creation of physical phenomena and of technical artefacts"

Feb 22 2012

Talk-10 **Masahiro Kawasaki** (Particle Cosmology / Professor, Institute for Cosmic Ray Research - ICRR, University of Tokyo, Japan)
"Axion Cosmology"

Talk-11 **Kunio Inoue** (Neutrino Physics / Professor, Research Center for Neutrino Science - RCNS, Tohoku University, Japan)
"Can matter-particle and antimatter-particle be the same?
-- Neutrino-less double beta decay search with KamLAND: KamLAND-Zen --"

Parallel Session A - Condensed Matter Physics / Philosophy

Feb 20 2012– Condensed Matter Physics

Talk-12 **Michael Brockmann** (Condensed Matter Physics / Doctoral student, University of Wuppertal, Germany)
"Mircrowave Absorption by Anti-Ferromagnetic Spin Chains"

Talk-13 **Joji Nasu** (Condensed Matter Physics / Assistant Prof., Tohoku University, Japan)
"Dynamical Jahn-Teller Effect in Spin-Orbital Coupled System"

Talk-14 **Sachiko Maki** (Condensed Matter Physics / Doctoral student, Nagoya University, Japan)
"Structural Study on Quasi One-dimensional Organic Conductor, $(TMTTF)_2PF_6$ by Synchrotron X-ray Diffraction"

Talk-15 **Shumpei Masuda** (Condensed Matter Physics /Assistant Prof., Tohoku University, Japan)
"Interference effects of helical current of two dimensional topological insulator"

Feb 21 2012– Condensed Matter Physics / Philosophy

Talk-16 **Hiroaki Matsueda** (Condensed Matter Physics, Associate Prof., Sendai National College of Technology, Japan)
"AdS/CFT correspondence in statistical and information physics"

Talk-17 **Satoshi Heguri** (Condensed Matter Physics / Assistant Prof., Tohoku University, Japan)
"Vibrations of guest atoms induced anomalous physical properties in type-1 clathrate"

Talk-18 **Shigeyuki Aoki** (Philosophy / Associate Prof., University of Aizu, Japan)
"Philosophy of Science Useful for Scientists?"

Talk-19 **Luca del Frate** (Philosophy / Doctoral student, Delft University of Technology, Holland)
"The creation of physical phenomena and of technical artefacts"

Parallel Session B - Particle Physics /Astrophysics

Feb 20 2012– Particle Physics

Talk-20 **Matsuo Sato** (Particle Physics / Associate Prof., Hirosaki University, Japan)
"3-algebra Model of M-theory"

Talk-21 **Hisataka Furuta** (Particle Physics / Dr., Tohoku University, Japan)
"Double Chooz Experiment– A search for neutrino mixing angle θ_{13}"

Talk-22 **Tsuguhiko Asakawa** (Particle Physics / Assistant Prof., Tohoku University, Japan)
"Noncommutative Solitons of Gravity"

Feb 21 2012– Astrophysics

Talk-23 **Mireya Etxaluze Azkonaga** (Astrophysics / Dr., Centro de Astrobiologia, Instituto Nacional de Técnica Aeroespacial (CSIC/INTA) Spain)
"Herschel/SPIRE FTS observations of the Sagittarius B2 molecular cloud"

Talk-24 **Daisuke Nitta** (Astrophysics / Assistant Prof., Tohoku University, Japan)
"Shadows of multi-black holes in de Sitter space-time"

Talk-25 **Lauranne Lanz (**Astrophysics / Doctoral student, Harvard-Smithsonian Center for Astrophysics - CfA, USA)
"Investigating Galaxy Interactions from the Ultraviolet to the Far-Infrared"

Talk-26 **Mikito Tanaka** (Astrophysics, /Assistant Prof., Tohoku University, Japan)
"Galactic Archaeology - Observational Studies of the Stellar Halo of the Andromeda Galaxy using Subaru telescope"

Parallel Session C - Nuclear Physics /Mathematics

Feb 20 2012– Nuclear Physics

Talk-27 **Patrick Achenbach** (Nuclear Physics / Dr., Institute of Nuclear Physics, Joh. Gutenberg University, Germany)
"High-precision form factor measurements at MAMI"

Talk-28 **Masatoshi Itoh** (Nuclear Physics / Assistant Prof., CYRIC, Tohoku University, Japan)
"The 2^+ excitation of the Hoyle state in ^{12}C"

Talk-29 **Takeshi Koike** (Nuclear Physics / Assistant Prof., Tohoku University, Japan)
" γ -ray spectroscopy of *sd*-shell hypernuclei at J-PARC
"

Feb 21 2012–Mathematics

Talk-30 **Tomohiro Fukaya** (Mathematics / Dr., Kyoto University, Japan)
"Coarse Baum-Connes conjecture for relatively hyperbolic groups"

Talk-31 **Takato Uehara** (Mathematics / Assistant Prof., Tohoku University, Japan)
"Ergodic Theory of Painlevé VI"

Talk-32 **Takahiro Okabe** (Mathematics / Assistant Prof., Tohoku University, Japan)
"Initial profile for the slow decay of the Navier-Stokes flow in the half-space"

Talk-33 **Mamoru Tanaka** (Mathematics / Assistant Prof., Tohoku University, Japan)
"Higher eigenvalues of the Laplacian on a graph and partitions of the graph"

Poster presentations

P- no.	Title / Name
1	**"The spatial dispersion effect in stratified metal-dielectric metamaterial"** **Aunuddin Syabba Vioktalamo** (Physics, D2)
2	"**Resonance femtosecond stimulated Raman spectroscopy: development and application to vibration of excited state"** **Kenta Abe** (Physics, D3)
3	"**Electronic State and Superconducting of Heavy Fermion $CeRhSi_3$"** **Hiroki Iida** (Physics, D1)
4	**"Accurate Crystal Structure Analysis of $YTiO_3$ by Synchrotron X-ray Diffraction"** **Yoshihisa Ishikawa** (Physics, D3)
5	**"Terahertz Time Domain Spectroscopy of Dimer Mott Insulator"** **Keisuke Ito** (Physics, D1)
6	**"Investigating of the topological order in the quantum Hall effect"** **Toru Ito** (Physics, D1)
7	**"Structure of neutron-rich nucleus ^{31}Ne deduced from nuclear reactions"** **Yasuko Urata** (Physics, D1)
8	**"Oscillatory Instability of Slow Crack Propagation in Rubbers under Large Deformation"** **Daiki Endo** (Physics, D3)
9	**"Properties of proton-rich unstable nuclei and two-proton radioactivity"** **Tomohiro Oishi** (Physics, D2)
10	**"Equilibrium states of polymer-containing micells"** **Yutaka Oya** (Physics, D2)
11	**"Shot noise measurements for a Kondo-correlated quantum dot in the unitary limit"** **Yuma Okazaki** (Physics, D3)
12	**"The analysis of Lambda hypernuclear spectroscopic experiment via (e,e'K^+) reaction at JLab Hall-C"** **Daisuke Kawama** (Physics, D3)
13	"**Coherent double pion photoproduction on the deuteron"** **Chigusa Kimura** (Physics, D2)
14	**"Lambda hypernuclear spectroscopic experiment with the high quality electron beam at JLab"** **Toshiyuki Gogami** (Physics, D2)
15	**"Electron microscopy and spectroscopy studies of organic molecules inside SWCNT"** **Mahbubul Haque**
16	**"New geometric interpretation of D-branes and DBI action"** **Shuhei Sasa** (Physics, D1)

17	**"Study of B→DK, D→K_SKπ for the measurement of CP -violating angle φ_3, and D^*→Dπ, D →K_SKπ for the modeling of D→K_SKπ Dalitz plane"** **Zenmei Suzuki** (Physics, D2)
18	**"Description of single-Lambda hypernuclei with a relativistic point coupling model"** **Yusuke Tanimura** (Physics, D1)
19	**"Boundary state analysis on the equivalence of T-duality and Nahm transformation in superstring theory"** **Yoshiro Teshima** (Physics, D2)
20	**"Statics and Dynamics of Wormlike Micellar Systems"** **Masatoshi Toda** (Physics, D3)
21	**"Study of light hypernuclei with the Stochastic Variational Method"** **Yoji Nakagawa** (Physics, D3)
22	"**Study of B^0→DK^{*0}(892) following by D→K^+pi^- at Belle"** **Kentaro Negishi** (Physics, D1)
23	**"DMRG study of the ground state phase diagram of interacting massless Dirac fermions in graphene under magnetic field"** **Tatsuya Higashi** (Physics, D3)
24	**"Cosmologically viable gauge mediation"** **Hiraku Fukushima** (Physics, D1)
25	**"Study of the Lambda photoproduction with Neutral Kaon Spectrometer 2"** **Takao Fujii** (Physics, D2)
26	**"Statistical analysis of human written language"** **Sho Furuhashi** (Physics, D3)
27	**"Analysis of the hypernuclear γ -ray spectroscopy of $^{12}_{\Lambda}$C and $^{11}_{\Lambda}$B via the (pi^+, K^+) reaction"** **Kenji Hosomi** (Physics, D3)
28	**"Electrostatic potential analysis of ferroelectric phase of hexagonal $YMnO_3$ using convergent-beam electron diffraction"** **Daisuke Morikawa** (Physics, D3)
29	**"X-ray exposure effect on charge-orbital order in Fe-doped layered manganites $La_{0.5}Sr_{1.5}Mn_{1-x}Fe_xO_4$"** **Yuuki Yamaki** (Physics, D2)
30	"**Theory of Superconductivity in fullerides by the repulsive interaction model"** **Satoshi Yamazaki** (Physics, D1)
31	**"Improvement of the detector systems for Neutral Kaon Spectrometer 2"** **Fumiya Yamamoto** (Physics, D1)
32	**"Role of non-collective excitations in heavy-ion reaction around the Coulomb barrier"** **Shusaku Yusa** (Physics, D2)
33	**"Laser cooling of GaAs/AlGaAs cantilever by exciton-related optical absorption"** **Takayuki Watanabe** (Physics, D2)

34	**"Magnetic properties of lightly electron doped $LaCoO_3$"** **Masanori Watahiki** (Physics, D2)
35	**"On the development of resonant inelastic x-ray scattering for high-pressure experiments"** **Masahiro Yoshida** (Physics, D3)
36	**"Terahertz pulse shaping via difference frequency mixing of shaped optical pulses"** **Kouji Uematsu** (Physics, D2)
37	**"Spectral-Function Sum Rules in Supersymmetry Breaking Models"** **Mitsutoshi Nakamura** (Physics, D2)
38	"**Laser Raman spectroscopy and the D band of grapheme"** **Nobuhiko Mitoma** (Physics, D2)
39	"**Theory of coherent phonon oscillations in carbon nanotubes and graphene nanoribbons"** **Ahmad Ridwan Tresna Nugraha** (Physics, D1)
40	**"High energy-resolution EELS and SXES studies on characteristic chemical shifts and charge transfer in Al-Si-Mn and Zn-Mg-Zr alloys"** **Shogo Koshiya** (Physics, D3)
41	**"Double Chooz: A search for the Neutrino Mixing angle θ_{13}"** **Thiago Junqueira De Castro Bezerra** (Physics, D1)
42	**"Evidence for Quantum Magnetotransport of Dirac Cone States in $Ba(FeAs)_2$"** **Huynh Kim Khuong** (Physics, D1)
43	**"Research of Transmission-line STJ Detector for Terahertz Band"** **Kenta Takahashi** (Physics, D1)
44	**"An investigation of the photoinduced production of strangeness in the threshold energy range"** **Brian O'neil Beckford** (Physics, D3)
45	**"Simple model for rupture process of pressure-sensitive adhesives"** **Shinobu Sekine** (Physics, D1)
46	**"Crystal growth of new target systems for high-energy neutron-scattering measurements at J-PARC"** **Kenji Tsutsumi** (Physics, D1)
47	**"A structural change of the vesicles in a nonequilibrium system including a chemically reacting system"** **Shinsuke Fukaya** (Physics, D1)
48	**"A uniformity test of BGO crystals to be used for an EM calorimeter"** **He Qinghua** (Physics, D1)
49	**"Magnetic properties of potassium doped polyacene: anthracene, tetracene, pentacene"** **Phan Thi Nhu Quynh** (Physics, D1)
50	**"Porting linux to MoGURA frontend electronics"** **Xu Benda** (Physics, D1)
51	**"Scanning tunneling microscopy of electronic properties of bulk and layered MoS_2"** **Amin Vakhshouri** (Physics, D1)

52	**"Quasinormal modes of charged anti-de Sitter black holes"** **Nami Uchikata** (Astronomy, D2)
53	**"The star formation in the SSA22 protocluster at z=3.09"** **Mariko Kubo** (Astronomy, D1)
54	**"Consistency Relation for multi-field inflation scenario"** **Naonori Sugiyama** (Astronomy, D2)
55	**"Path Integral Analysis of Bianchi I spacetime in Loop Quantum Cosmology"** **Kazuya Fujio** (Astronomy, D2)
56	**"The origin of low-luminosity AGN/AGN-like activity in red early-type galaxies"** **Takayuki Maebayashi** (Astronomy, D1)
57	**"Leaf-wise intersections in coisotropic submanifolds"** **Satoshi Ueki** (Mathematics, D1)
58	**"Modified wave operator for the 2d nonlinear Schrödinger system with mass resonance"** **Kouta Uriya** (Mathematics, D1)
59	**"The law of the iterated logarithm for G-Brownian motion"** **Emi Osuka** (Mathematics, D1)
60	**"On elliptic surfaces related to Beilinson's Tate conjecture"** **Mariko Ohara** (Mathematics, D1)
61	**"On Legendrian minimal submanifolds in Sasakian manifolds"** **Toru Kajigaya** (Mathematics, D1)
62	**"Calibrated submanifolds"** **Kotaro Kawai** (Mathematics, D1)
63	**"Homogeneous Reinhardt domains of Stein in the complex n-space"** **Kouichi Kimura** (Mathematics, D1)
64	**"On the density of some sequences of integers"** **Rena Tateda** (Mathematics, D1)
65	**"On the formal group of the Jacobian"** **Tomonori Nakayama** (Mathematics, D1)
66	**"On the enhancement to the Milnor number of a class of mixed polynomials"** **Kazumasa Inaba** (Mathematics, D2)
67	**"Heat kernel estimates for Markov processes associated with perturbed Dirichlet forms"** **Masaki Wada** (Mathematics, D1)
68	**"Location of the concentration point in the ground-state solution of a reaction-diffusion equation in a heterogeneous medium"** **Hiroko Yamamoto** (Mathematics, D1)
69	**"Weak Determinacy of Infinite Games and Corresponding Hierarchy of Inductive Definitions"** **Keisuke Yoshii** (Mathematics, D1)

70	**"On the orbit space of certain prehomogeneous vector spaces"** **Kazuaki Tajima** (Mathematics, D3)
71	**"The characterization of a pinned polymer"** **Yasuhito Nishimori** (Mathematics, D3)
72	**"Asymptotic Behavior of Non-local Feynman-Kac Semigroups"** **Masakuni Matsuura** (Mathematics, D3)
73	**"Network Games with and without Synchroneity"** **Ahmad Termimi Bin Ab Ghani** (Mathematics, D3)
74	**"An ODE-diffusion system modeling regeneration of Hydra"** **Madoka Nakayama** (Mathematics, D3)
75	**"Periodic decomposition of functions holomorphic in domains containing convex polygons"** **Takanao Negishi** (Mathematics, D3)
76	**"Lower bounds of the canonical heights on certain elliptic curves"** **Tadahisa Nara** (Mathematics, D3)
77	**"Relative Randomness for Martin-Löf Random Sets"** **Ning-Ning Peng** (Mathematics, D1)
78	**"Smoothness of densities of generalized locally non-degenerate Wiener functionals"** **Nobuaki Naganuma** (Mathematics, D1)
79	**"Viscosity solutions on a Riemannian manifold"** **Abdullah Kizilay** (Mathematics, D1)
80	**"The rationality of the Precautionary principle: making the precautionary principle more applicable"** **Yasuhiko Fujio** (Philosophy, D3)
81	**"Hume on Logic and Demonstration"** **Hiromichi Sugawara** (Philosophy, D3)
82	**"The problem of the relationship between individuality and universality in Hegel's philosophy"** **Yuusuke Minegishi** (Philosophy, D2)
83	**"Prolegomena revisited"** **Masatoshi Echigo** (Philosophy, D1)
84	**"On the Myth-Making Function in Bergson"** **Koki Tamura** (Philosophy, D1)
85	**"The concept of objectification in life philosophy and natural science"** **Marika Hirama** (Philosophy, D1)
86	**"Autonomous decision-making and informed consent"** **Haruka Hikasa** (Philosophy, D3)

Abstracts of Talks

Plenary Session - Feb 20

Talk-01 (Particle Physics)

Space-time quantum geometry

Peter Schupp
Jacobs University Bremen, Germany

Abstract:

Two fundamental physical theories govern essentially all phenomena in the observable world. The first theory, General Relativity, is of geometric type and describes space-time and gravity. It governs large-scale physics including stars, galaxies, black holes and cosmology. The second theory, quantum mechanics, is of algebraic type and governs physics at the atomic scale and below. In the form of quantum field theory, it describes all fundamental forces and elementary particles. While either one of these two theories is in itself immensely successful, we also know that the two are mathematically incompatible. At length scales where both gravitational and quantum effects become important, we must replace our concept of smooth space-time by a more general notion that unites geometric and algebraic ideas. Non-commutative geometry is an excellent candidate for this task and motivates the development of non-commutative versions of the standard physical theories. The resulting effective theories have the potential to capture some aspects of the quantum geometric structure of space-time that is expected to arise in any fundamental theory of quantum gravity. Predictions of these theories include new exotic interactions of elementary particles and quantum black holes that quite naturally exhibit holographic behavior. Non-commutative geometry and higher quantum geometric structures also appear quite naturally in string and M-theory, which are current candidates for truly fundamental theories of physics. The underlying mathematics has applications in several other fields of physics.

In this presentation, an overview of the subject and recent developments will be given.

Talk-02 (Condensed Matter Physics)

Dynamics of superfluids and quasiparticles in iron-based superconductors investigated by microwave to terahertz conductivity measurements

Yoshinori Imai

Department of Basic Sciences, the University of Tokyo, Japan

Abstract:

Since the discovery of superconductivity in F-doped LaFeAsO [1], the iron-based superconductors have attracted much attention for the following reasons; (1) "magnetic" element, Fe, occupies the most essential part in the crystal structure and the band structure, (2) multiple band character plays an important role for the superconductivity, and (3) T_c is rather high (next to cuprate superconductors). So-called $s_{\pm}$-wave superconducting gap where sign of the gap is reversed between electron and hole Fermi-surface pockets is regarded as a probable scenario in these systems. Some important aspects of the electronic structure for these materials, however, depend very sensitively on small changes in interatomic distances and bond angles within the iron-pnictogen subunit. Therefore, the details of the gap structures strongly depend on materials. It is important to understand what the universal feature is among the various iron-based superconductors in order to understand the mechanism of their superconductivity. We investigated charge excitations of $BaFe_2As_2$ (122), LiFeAs (111), and FeSe (11) systems from microwave to terahertz (THz) regions. The temperature dependence of the magnetic penetration depth, which is estimated from the microwave surface impedance, of 111 and 11 materials shows that there is no nodes in the superconducting gap function [2-4]. As for the temperature dependence of superfluid density, some of which show peculiar behaviors that are different from those of the conventional BCS superconductors. From the result of conductivity measurement, it turned out that the mean free path of quasiparticle plays an essential role. I also discuss about the conductivity spectra of 122 thin films in the THz region [5]. Above the spin-density-wave (SDW) transition temperature, the conductivity spectra follow the Drude model. In the SDW state, the imaginary part of the complex conductivity is suppressed in comparison to that expected according to the Drude model. The real part exhibits nearly Drude-like behavior. This behavior is related with the quasiparticles in the Dirac cone that exists at a part of Fermi surface of $BaFe_2As_2$. In other words, the dynamics of Dirac fermions can be observed through the conductivity spectra of $BaFe_2As_2$, clearly.

[1] Y. Kamihara *et al*., J. Am. Chem. Soc., **130** (2008) 3296.

[2] Y. Imai *et al*., J. Phys. Soc. Japan, **80** (2011) 013704.

[3] H. Takahashi *et al*., Phys. Rev. B, **84** (2011) 132503.

[4] Y. Imai *et al*., Physica C, **471** (2011) 630., *also* T. Okada *et al*., arXiv: 1110.6575.

[5] D. Nakamura *et al*., Physica C, **471** (2011) 634.

Talk-03 (Astrophysics)

Star Formation Near and Far: Recent Smithsonian Infrared-Submillimer Research

Howard Smith

Harvard-Smithsonian Center for Astrophysics - CfA, USA

Abstract:

The formation of stars, especially massive stars, is a key process in the evolving universe. Star birth dramatically disrupts the local environment via ultraviolet radiation and outflowing jets, and the supernova death of young massive stars disperses all the heavy elements into the cosmos. Star formation lights up distant galaxies in the early universe, making them detectable, and enabling cosmological studies. Not least, the formation of stars includes the birth of planets and planetary systems. Because the early stages of star formation takes place inside dark clouds of dust, infrared observations are vital, and infrared astronomy from space has enabled dramatic advances in our knowledge of star formation. In this talk I will review infrared research on star formation being done at the Smithsonian Astrophysical Observatory, including mention of technology and detector development.

Talk-04 (Mathematics)

Synchronization
- A bifurcation theory of infinite dimensional dynamical systems -

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The dynamics of systems of large populations of coupled oscillators have been of great interest because collective synchronization phenomena are observed in a variety of areas. The Kuramoto model is often used to investigate such phenomena, which is a system of differential equations of the form

$$\frac{d\theta_k}{dt} = \omega_k + \frac{K}{N}\sum_{j=1}^{N} f(\theta_j - \theta_k),\ k = 1, \cdots, N. \tag{1}$$

In this talk, an infinite dimensional Kuramoto model is considered, and the Kuramoto's conjecture on a bifurcation diagram of the system, which is open since 1985, is proved.

It is well known that the spectrum (eigenvalues) of a linear operator determines a local dynamics of a system of differential equations. Unfortunately, the infinite dimensional Kuramoto model has the continuous spectrum on the imaginary axis, so that the usual spectral theory does not say anything about the dynamics. For handle such continuous spectra, a new spectral theory of linear operators based on Gelfand triplets is developed. Basic notions in the usual spectral theory, such as eigenspaces, algebraic multiplicities, point/continuous/residual spectra, Riesz projections are extended to those defined on a Gelfand triplet. They prove to have the same properties as those of the usual spectral theory. The results are applied to the Kuramoto model to prove the Kuramoto's conjecture.

References.

[1] H.Chiba, A spectral theory of linear operators on rigged Hilbert spaces under certain analyticity conditions, (arXiv:1107.5858).
[2] H.Chiba, A proof of the Kuramoto's conjecture for a bifurcation structure of the infinite dimensional Kuramoto model, (arXiv:1008.0249).
[3] H.Chiba, I.Nishikawa, Center manifold reduction for a large population of globally coupled phase oscillators, Chaos, 21, 043103 (2011).

Plenary Session - Feb 21

Talk-05 (Nuclear Physics)

Neutron Stars with Hyperons and Quarks

Hans-Josef Schulze

Sezione INFN, Dipartimento di Fisica, Universita' di Catania, Italy

Abstract:

The high-density nuclear equation of state within the Brueckner-Hartree-Fock theoretical many-body approach is discussed. Particular attention is paid to the possible presence of exotic particles like hyperons, and the joining with an eventual quark matter phase. The resulting properties of neutron stars, in particular the mass-radius relation, are determined and compared with recent observational data. It turns out that in this approach stars heavier than about 1.4 solar masses contain necessarily quark matter.

Talk-06 (Condensed Matter Physics)

Exact results for many body systems by use of the Yang-Baxter equation and related algebraic structures

Andreas Klümper

Department of Physics, Wuppertal University, Germany

Abstract:

The properties of matter are believed to be fully described by quantum mechanics and statistical mechanics. However, only for the ideal quantum gases we have a full understanding of their thermodynamical properties. For interacting particles the quantum statistical computations are difficult to carry out, but the physical properties are much richer than in the ideal gas cases. In general, only approximate methods are applicable and the domain of reliability is restricted to for instance high temperatures or low densities.

There exist a number of so-called integrable systems, notably in low spatial dimensions, which allow for exact computations of their thermodynamical properties despite the existence of interactions between the particles. Examples of integrable quantum systems are Heisenberg and Hubbard chains, the Kondo problem and Bose gases with contact interactions. The fundamental reason for the exact solvability of the physical properties of these systems is the existence of a large number of conserved quantities. The local condition for the existence of these quantities is the Yang-Baxter equation.

In my talk, I want to show how to further use the Yang-Baxter equation to derive functional equations for the generating functions of the conserved quantities and how to solve them. These

equations are known in the literature under the acronyms "T- and Y-systems". The results comprise explicit expressions for the thermodynamical potentials of the many-particle systems. If time permits I will give an outlook on very recent work on the correlation functions of integrable models.

Talk-07 (Astrophysics)

Accelerating expansion of the universe and testing gravity on cosmological scales

Kazuhiro Yamamoto
Hiroshima University, Japan

Abstract:

The 2011 Nobel Prize in Physics was awarded "for the discovery of the accelerating expansion of the Universe through observations of distant supernovae" to S. Perlmutter, B. P. Schmidt and A. G. Riess. I start my talk from reviewing the meaning of this discovery, which has played a role of driving force of active researches in theoretical and observational cosmology. The accelerated expansion of the universe might be explained by long distance modification of the gravity theory. The galileon model is recently investigated as such a modified gravity model, whose phenomenology applied to cosmology will be discussed in my talk. I will also discuss about testing the modified gravity model by means of cosmological observations.

Talk-08 (Mathematics)

On vorticity formulation for viscous incompressible flows in the half plane and its application to the inviscid limit problem

Yasunori Maekawa
Department of Mathematics, Kobe University, Japan

Abstract:

In this talk we consider viscous incompressible flows in the half plane equipped with the no-slip boundary conditions for velocity fields. In particular, we are interested in the behavior of the vorticity fields of the flow, where a difficulty arises mainly in their boundary conditions which are non-local and nonlinear. By using the Fourier-Laplace transform we first derive the solution formula for the associated linearized vorticity equations. The solution formula is then applied to prove the solvability of the vorticity equations. Next we study the behaviors of vorticity fields at the vanishing viscosity limit, where the high creation of vorticity occurs in the boundary layer. By using the solution formula we rigorously verify that the inviscid limit behavior of the flow is described by the Euler solution in the inner region and the Prandtl-type solution in the boundary layer region, if the support of the initial vorticity field is away from the boundary.

Talk-09 (Philosophy)

The creation of physical phenomena and of technical artefacts

Peter Kroes

Delft University of Technology, the Netherlands

Abstract:

The distinction between the natural world ("nature") and the world of human made technical artefacts ("technology") plays a crucial role in human thinking and doing. For instance, according to most patent laws intellectual property rights may only be granted for human inventions and not for natural objects; patents are only possible for things created by human beings. Roughly, the distinction between the domain of the natural and the artificial is still drawn in an Aristotelian way as the distinction between on the one hand objects/phenomena that have come about without human intervention, that is, have come about by their own nature or principle of motion, and on the other hand objects/phenomena created intentionally by human beings. However, philosophers of science, in particular Ian Hacking in his book Representing and Intervening (1983), have claimed that also physical phenomena are human creations. Indeed, physicists are not simply passive observers but create all kinds of phenomena in their laboratories. This raises the question of what - if anything - is special about the creation of technical artefacts in comparison to the creation of physical phenomena. In order to deal with this question I will start by comparing a description of a thing as a physical object (from a physical stance) with a description of the 'same' thing as a technical artefact (from a design stance). This will show that functions play a crucial role in distinguishing technical artefacts from physical objects. These functions are intimately related to the fact that technical artefacts are designed objects. Technical artefacts are the embodiments of human designs and therefore have a dual nature: they have physical features and features that are related to human intentions. This is not the case for physical phenomena. On the basis of this I will make a distinction between creating things in a weak and a strong sense and I will show that the creation of technical artefacts involves creation in the strong sense, whereas physical phenomena are created in a weak sense.

Plenary Session - Feb 22

Talk-10 (Particle Cosmology)

Axion Cosmology

Masahiro Kawasaki
Institute for Cosmic Ray Research - ICRR, University of Tokyo, Japan

Abstract:

Axion is a Nambu-Goldstone boson predicted in the Peccei-Quinn mechanism which was invented by Peccei and Quinn in 1977 to solve the strong CP problem in the standard model of particle physics. Axion is stable and a good candidate for dark matter. Axion and other fields associated with Peccei-Quin mechanism have interesting cosmological effects. I will discuss various cosmological phenomena due to axions.

Talk-11 (Neutrino Physics)

Can matter-particle and antimatter-particle be the same? -- Neutrino-less double beta decay search with KamLAND: KamLAND-Zen --

Kunio Inoue
Research Center for Neutrino Science - RCNS, Tohoku University, Japan

Abstract:

Matter dominance in the universe and very light neutrino mass are included in the biggest open questions in cosmology and elementary particle physics. These fundamental questions might be explained if neutrinos and anti-neutrinos are the same. Only neutrinos among known matter particles might have such a feature called Majorana nature. Neutrino-less double beta decay is a nuclear process in which two neutrinos from two simultaneous beta decays annihilate, and thus it provides an evidence of Majorana nature. Search for the neutrino-less decay is so-far the only feasible method to investigate Majorana nature of neutrinos. In September 2011, the world largest experiment for the search, KamLAND-Zen has been started in Kamioka, Japan. And the first results from KamLAND-Zen will be presented.

Parallel Session A - Feb 20 - Condensed Matter Physics

Talk-12 (Condensed Matter Physics)

Microwave absorption by anti-ferromagnetic spin chains

Michael Brockmann

Department of Physics, University of Wuppertal, Germany

Abstract:

We analyze the absorption of microwaves by the one-dimensional Heisenberg-Ising magnet exposed to a static magnetic field. This model is most relevant for the description of the low-energy behavior of quasi one-dimensional anti-ferromagnetic materials, such as $LiCuVO_4$, which is dominated by many-body effects. Due to the anisotropic exchange between electrons the sharp absorption resonance, which would be expected for paramagnetic materials, is shifted and broadened. In experiments of electron spin resonance (ESR) this effect is usually quantified by measuring the maximum of the absorption profile and the distance between the inflection points. We argue that, from a theoretical point of view, it is more appropriate to define the resonance shift and the line width by means of the first few moments of the absorbed intensity. These are determined by short-range correlation functions.

Due to the integrability of the model short-range correlation functions can be calculated exactly over the whole range of temperatures and for arbitrary magnetic fields. Thus, we obtain exact results for the resonance shift and the line width of the absorbed intensity of a strongly correlated quantum system. Additionally, we performed numerical calculations of the full absorption profile which are supported by the exact data.

Talk-13 (Condensed Matter Physics)

Dynamical Jahn-Teller effect in spin-orbital coupled system

Joji Nasu and Sumio Ishihara

Department of Physics, Tohoku University, Japan

Abstract:

Orbital degree of freedom is one of the most attractive themes in strongly correlated electron system. A coupling between the orbital and the lattice vibration is known as a Jahn-Teller effect (JTE). The dynamical aspect of the Jahn-Teller interaction is often neglected in solid, because it is strongly suppressed by the cooperative JTE. Recently, $Ba_3CuSb_2O_9$ has been reported as a candidate of the spin liquid. A Cu^{2+} has the e_g orbital degree of freedom and is surrounded by the O^{2-} octahedron. The octahedra on the neighboring sites do not have the common O ions. This fact implies that the cooperative JTE is weak, and the dynamical JTE is expected to play some key roles on orbital and magnetic properties. The purpose of this research is to study the dynamical JTE in a spin-orbital coupled system. In particular, we focus on competitive or cooperative phenomena between the superexchange interaction and the DJTE. A superexchange interaction part is derived from the *d-p* model and the

DJTE part for the low lying vibronic states is described by the orbital pseudo-spin and the lattice vibration. We analyze the model which combines the two interactions on a honeycomb lattice by using the Bethe approximation and the exact diagonalization method. We find that the magnetic order is unstable in a wide parameter region and a spin-singlet dimer state associated with an orbital order is realized. With increasing the DJTE, furthermore, the orbital order is strongly suppressed and a resonance state of the spin-orbital dimers appears.

[1] H. D. Zhou, et.al., Phys. Rev. Lett., 106 (2011) 147204.

Talk-14 (Condensed Matter Physics)

Structural Study on Quasi One-dimensional Organic Conductor, $(TMTTF)_2PF_6$ by Synchrotron X-ray Diffraction

Sachiko Maki

Department of Applied Physics, Nagoya University, Japan

Abstract:

An organic conductor, $(TMTTF)_2PF_6$ (tetra-methyl-tetra-thia-fulvalene), is one of the $(TMTTF)_2X$ family which has attracted interests of many researchers for its complicated pressure-temperature diagram [1]. The $(TMTTF)_2X$ family has a quasi-one-dimensional structure consists of the stacking TMTTF molecules and have a half-filled band structure owing to the weak dimerization of the TMTTF molecules in the metallic state. The metallic behavior of $(TMTTF)_2PF_6$ at room temperature changes with decreasing temperature: an insulator, a charge ordering (CO) state, a spin-singlet (SS) state at ambient pressure. In addition, this system shows a superconducting state under pressure. In addition to the intrinsic dimerization and the inter-chain interactions, the electronic correlations play an important role for understanding many electronic phases [2,3].

The mystery around the CO transition arising from the fact that no lattice effects have been observed by neutron diffraction measurement [4] is known as the ‘‘structureless transition’’. In the SS state, the superlattice reflections have been observed [5,6]. The x-ray structural analysis including the superlattice reflections has not completed yet because of the fact that the intensities of the superlattice reflections decay with exposure time [5]. To elucidate the relation between the crystal structure and electronic states, the investigations of the molecular arrangement and charge distribution have been highly desired.

We have performed the accurate structural analysis of $(TMTTF)_2PF_6$ for the insulator, CO, and SS phases using synchrotron x-ray diffraction data at SPring-8. In this presentation, we will report (i) the crystal and molecular structures including the charges on the TMTTF molecules in the CO phase and (ii) the crystal structure in SS states.

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Talk-15 (Condensed Matter Physics)

Interference effects of helical current of two dimensional topological insulator

S. Masuda and Y. Kuramoto

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Abstract:

We introduce a chain model which describes the helical spin current on the edge of two-dimensional topological insulator. We explore quantum interference effects between the counter-propagating spin current on the edge by using the chain model with long-range hopping. The remarkable change in spin state of the transmitted electron is found by varying the energy of the conducting electron and the arm lengths of the interferometer. We show that the helical-current interferometer can manipulate the spin state of the conducting electron and would be useful for the analysis of the energy dispersion of the edge state in the topological insulator. It is also shown that the interferometer with three leads can generate spin-polarized current from spin-unpolarized injection.

Parallel Session A – Feb 21 - Condensed Matter Physics / Philosophy

Talk-16 (Condensed Matter Physics)

AdS/CFT correspondence in statistical and information physics

Hiroaki Matsueda

Sendai National College of Technology, Japan

Abstract:

In quantum spin chains at criticality, two types of scaling for the entanglement entropy exist: one comes from conformal field theory (CFT), and the other is for entanglement support of matrix product state (MPS) approximation. On the other hand, the quantum spin-chain models can be mapped onto two-dimensional (2D) classical ones by the Suzuki-Trotter decomposition. Motivated by the scaling and the mapping, we examine new von Neumann entropy for 2D classical spin configurations in the Ising and the 3-state Potts models on the square lattice. The entropy is defined by the singular values of the reduced density matrix for a Monte Carlo snapshot. We find scaling relations of the entropy compatible with the CFT and the MPS results. Thus, we propose that the entropy is a kind of 'holographic' entanglement entropy of 1D quantum systems. At T_c, the spin configuration is fractal-like, and various sizes of ordered clusters coexist. Then, the singular values are related to decomposition of

the original snapshot into patterns with different length scales, respectively. This decomposition naturally leads to a discrete version of the Anti-de Sitter (AdS) space. Thus, we think that the concept of the AdS/CFT correspondence in superstring theory has more fundamental mathematical background. We will discuss dual nature of this new correspondence in various viewpoints. Close connection between AdS/CFT and other topics in statistical and information physics, such as entanglement renormalization and wavelet analysis, is also addressed.

Talk-17 (Condensed Matter Physics)

Vibrations of guest atoms induced anomalous physical properties in type-1 clathrate

Satoshi Heguri

Department of Physics, Tohoku University, Japan

Abstract:

Clathrate compounds have recently much attention because of their potential use in thermoelectric devices. Among a large number of clathrates, type- I clathrates $M_8Ga_{16}Ge_{30}$ (M = Ba, Sr, Eu) have been most extensively investigated. In the type- I clathrate, the guest atoms M are accommodated in two kinds of polyhedral cages of two dodecahedra and six tetrakaidecahedra. The guest atom can move in the larger cage. Crystal structural studies of $Eu_8Ga_{16}Ge_{30}$ (EGG) and $Sr_8Ga_{16}Ge_{30}$ (SGG) revealed that the guest atom site in the larger cage splits into for equivalent off-center positions which are 0.4 Å and 0.35 Å away from the on-center (cage center) position, respectively [1, 2]. This anharmonic motion, so-called “rattling motion”, leads clatherate to the phonon glass electron crystal.

In particular, type- I EGG shows ferromagnetic transition at T_{Curie} = 36 K. All of the Eu is divalent and long-range spin ordering of *f*-electron is interpreted through Ruderman-Kittel-Kasuya-Yoshida (RKKY) indirect exchange coupling via the conduction electrons spreading over the Ga and Ge network [3]. In the temperature dependence of electrical resistivity measurement of type- I EGG single crystal, broad hump can be observed below T_C. Onimaru et al. suggested that the existence of multiple ferromagnetic structures related with the rattling motions of guest Eu atoms in this temperature region [4], but the detailed remains to be unclear. It is necessary to create new type- I clathrate without anharmonic vibration of Eu atoms in order to understand the anomalous behavior in type- I EGG. Therefore, we synthesized single crystals of $Eu_xSr_{8-x}Ga_{16}Ge_{30}$ which was substituted by Sr atom at the Eu site in type- I EGG. $Eu_xSr_{8-x}Ga_{16}Ge_{30}$ system showed that T_C and saturated magnetization value decreased with decreasing Eu molar ratio x. Especially in case of the $Eu_2Sr_6Ga_{16}Ge_{30}$, no Eu atoms with anharmonic vibrations were revealed by single crystal x-ray diffraction study.

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Talk-18 (Philosophy)

Philosophy of Science Useful for Scientists"

Shigeyuki Aoki

University of Aizu, Japan

Abstract:

In this talk, I would like to consider the conditions under which fruitful relationship would be expected between philosophy and science, especially between philosophy of science (henceforth PS) and special sciences. Here I focus on "conditions" since the success/failure of cooperative research, in my belief, depends on what part of PS, what phase of scientific research, what kind of scientist/philosopher we are focusing on; just a scratch team of scientists and philosophers does not automatically yield anything progressive. I will show you why I make such a claim.

First, I will point out that science has various stages. According to the (widely accepted) Kuhnian model of scientific progress, scientific practice has roughly two phases: normal science and abnormal science. Normal science is characterized by "puzzle solving" within the settings of particular paradigms: Darwinian evolutionary theory, Einstein's relativity theory, Plate Techtonics, Standard Solar Model, etc. In this normal science stage, philosophical discourse does no more good to scientists than ornithology (study of birds) to birds. On the other hand, abnormal science is the phase in which the present, dominant paradigm is called into question; in this phase, basic philosophical questions arise such as "whether what you are doing is a good science", "what is the purpose of scientific study". So, it is in this abnormal science phase that the chance of cooperative research is high.

Second, we must pay attention to the fact that the present-day PS, started since 19th century, has itself reached quasi-normal science stage characterized by particular questions and puzzle solvings among professional philosophers. Meanwhile, the discrepany between "two cultures" seems to have grown too big to be bridged. So, it is wrong for us to expext good answers, from professional philosophers, to scientists' "philosophical" questions.

Nonetheless, there are still some areas, in PS, where fruitful encounter is possible between philosophers and scientists. By taking up several success/failure case examples, I will discuss what kind of uses of PS would enhance cooperative research. Besides, outside of orthodox PS, I will introduce some early efforts ("applied philosophy") of scientist-philosopher making a team to achieve cooperative research.

Talk-19 (Philosophy)

Failure of engineering artefacts: a life cycle approach

Luca del Frate
Delft University of Technology, Holland

Abstract:

The aim of this paper is to introduce a life cycle perspective on the notion of failure of engineered products. Usually failure is seen as an event that can occur during the utilization stage of products. Moreover, most definitions describe failure in terms of manifest termination of expected performance. The life cycle perspective expands this view by including failures occurring outside the utilization stage, and offers a categorization of phenomena that are arguably also taken as failures in engineering. The paper starts by considering previous attempts to take the life cycle into account when dealing with failure of engineering artefacts. A definition of failure suitable for the life cycle approach is proposed and applied to categorize a number of case stories and examples of failure occurring in different stages of the life cycle, confirming the engineering credibility of the approach. Moreover, it shows that the life cycle approach affords applying the notion of failure to events that can occur after the products are removed from service and are related to their sustainability.

Parallel Session B - Feb 20 - Particle Physics

Talk-20 (Particle Physics)

3-algebra Model of M-theory

Matsuo Sato
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Abstract:

BFSS matrix theory is one of the strong candidates of non-perturbative definition of superstring theory and many evidences were found. However, it seems impossible to derive full dynamics of M-theory from BFSS matrix theory because it treats D0-branes as fundamental degrees of freedom. For example, we do not know the manner to describe longitudinal momentum transfer of D0-branes. Therefore, we need a matrix model that treats membranes as fundamental degrees of freedom in order to derive full dynamics of M-theory.

We start with the Green-Schwartz supermembrane action in order to obtain matrix models of M-theory that treat membranes themselves as fundamental degrees of freedom. We show, by using an approximation, that the action reduces to that of a zero-dimensional gauge theory with volume preserving diffeomorphism (VPD) symmetry, if we fix the kappa-symmetry of the action to a semi-light-cone gauge. We propose two 3-algebra models of M-theory which are defined by replacing VPD algebra with finite-dimensional 3-algebras in the action. One of the two models is based on Hermitian 3-algebra (Hermitian 3-algebra model), whereas the other is based on Lie 3-algebra (Lie 3-algebra model). Because the 3-algebra models are gauge theories, matrix representations should be allowed and dynamics of many-body systems can be described by using diagonal blocks of matrices.

Especially, we study the Lie 3-algebra model with a Lorentzian Lie 3-algebra. This model is ghost-free despite the Lorentzian 3-algebra. We show that the model satisfies two criteria as a model of M-theory. First, we show that the model possesses N=1 supersymmetry in eleven dimensions. Second, we show the model reduces to BFSS matrix theory with finite size matrices in a discrete light-cone quantization (DLCQ) Limit as it should do: it is generally shown that M-theory reduces to such BFSS matrix theory in a DLCQ limit.

Talk-21 (Particle Physics)

Double Chooz Experiment – A search for neutrino mixing angle θ_{13}

Hisataka Furuta
Tohoku University, Japan

Abstract:

Double Chooz experiment will search for a disappearance of the reactor neutrinos from two 4.25 GW_{th} reactor cores at the Chooz Nuclear Power Plant in France, in order to detect the neutrino oscillation angle θ_{13}. The detectors are Gadolinium-loaded liquid scintillator with 10 m^3 fiducial volume. The far detector located at about 1km from the cores was completed in 2010 and data-taking has started in spring 2011. It was indicated that the disappearance consistent with neutrino oscillations as the first result in 101 days of the running in November 2011. Outline of Double Chooz experiment and the first result is presented.

Talk-22 (Particle Physics)

Noncommutative Solitons of Gravity

Tsuguhiko Asakawa
Department of Physics, Tohoku University, Japan

Abstract:

Field theories on noncommutative spaces have been well investigated, by considering them as effective quantum gravity models at the short length scale. Recently, there are several attempts to formulate noncommutative gravity models, which reproduce the Einstein's general relativity in the commutative limit. Here we propose an another possibility. We investigate a three-dimensional gravitational theory on a noncommutative space which has a cosmological constant term only. We found various kinds of nontrivial classical solutions, by applying a similar technique used to seek noncommutative solitons in noncommutative scalar field theories. Some of those solutions correspond to bubbles of spacetimes, and the Minkowski spacetime with and without singularities. Since they are non-perturbative in the noncommutative parameter, they are different from solutions found in other contexts of noncommutative gravity models and would have a close relation to quantum gravity. We will also report on a new kind of solutions, found recently by applying the method of the quantum optics.

Parallel Session B - Feb 21 - Astrophysics

Talk-23 (Astrophysics)

Herschel/SPIRE FTS observations of the Sagittarius B2 molecular cloud

Mireya Etxaluze Azkonaga
Centro de Astrobiologia, Instituto Nacional de Técnica Aeroespacial (CSIC/INTA), Spain

Abstract:

We present new unpublished far-infrared spectra of the Sagittarius B2 (SgrB2) molecular cloud observed with the Herschel-SPIRE Fourier Transform Spectrometer. The spectra show strong CO and ^{13}CO rotational ladders in emission. Other molecular lines are H_2O, SO and HCl. The whole region shows very strong absorption lines of a variety of hydrides: OH, CH^+, NH_3, HF, CH_2, NH and H_2O^+. The maps of several emission and absorption molecular lines across the region will be presented. We constrain the chemical and the physical conditions in the SgrB2 molecular cloud by reproducing the CO ladder with radiative transfer simulations, and we also analyze the far-infrared thermal dust emission using Herschel PACS and SPIRE photometric observations.

Talk-24 (Astrophysics)

Shadows of multi-black holes in de Sitter space-time

Daisuke Nitta
Tohoku University, Japan

Abstract:

We compute the black holes shadows in de Sitter space-time using the Kastor-Traschen cosmological multi-black hole solution that is an exact solution describing the collision of maximally charged black holes with a positive cosmological constant. We find that in addition to the shadow of each black hole, an eyebrowlike structure appears as the black holes come close to each other. These features can be used as probes to find the multiblack hole system at the final stage of its merger process.

Talk-25 (Astrophysics)

Investigating Galaxy Interactions from the Ultraviolet to the Far-Infrared

Lauranne Lanz
Harvard-Smithsonian Center for Astrophysics - CfA, USA

Abstract:

The evolution of galaxies is greatly influenced by their interactions. As part of a program to study these galaxies, we have imaged 50 systems, and measured and modeled the spectral energy distributions (SEDs) of a set of galaxies at wavelengths from the ultraviolet (UV) to the far-infrared (FIR). We describe the relative importance of FIR Herschel and UV GALEX observations in constraining such parameters as star formation histories and dust mass and temperatures. The sample is based on the Spitzer Interacting Galaxy Survey (SIGS), which was designed to probe a range of galaxy interaction parameters in the infrared. It is comprised of the Keel-Kennicutt (Keel et al. 1985) complete sample of interacting galaxies chosen on the basis of association likelihood. The resulting sample contains 113 galaxies in 50 systems located within cz < 4000 km/s. The sample presented here is the sample for which Herschel SPIRE observations are publicly available. We present these data and the variations in star formation histories seen across the interaction sequence as outlined by this sub-sample, using the latest SED model developed by de Cunha et al.

Talk-26 (Astrophysics)

Galactic Archaeology - Observational Studies of the Stellar Halo of the Andromeda Galaxy using Subaru telescope

Mikito Tanaka
Tohoku University, Japan

Abstract:

In this meeting, we present previous important studies and observational plans about the stellar halo of the Andromeda galaxy (M31) using Subaru telescope. According to Galactic Archaeological interests, M31 is one of unique laboratories to examine galaxy formation scenario since we can ethnographically investigate stellar population and structure of its halo based on detailed photometric and spectroscopic observations of individual old stars. In particular, the fact that many stellar density substructures such as a stellar stream and a shell have been found around M31 strongly supports hierarchical galaxy formation scenario through a lot of merging events of dwarf galaxies. However, considering the amount of predicted substructures, what we have known about such a scenario is only part of M31's formation history over 10 Gyr. To work on such an important problem, we have been planning a whole area survey of M31's halo using Subaru's next-generation instruments such as Hyper Suprime-Cam (HSC) and Prime Focus Spectrograph (PFS). One of our main goals of the studies is to completely describe fundamental properties of M31's outer halo such as stellar density, abundance and kinematics, which are important clues to restrict structure and formation scenario of stellar halos of galaxies.

Parallel Session C - Feb 20 - Nuclear Physics

Talk-27 (Nuclear Physics)

High-precision form factor measurements at MAMI

Patrick Achenbach

Institut für Kernphysik, Joh. Gutenberg-University, Mainz, Germany

Abstract:

The electric and magnetic form factors of the proton encode information on the spatial distribution of charge and magnetization. From the form factors the charge and magnetic radii can be determined which are fundamental parameters in nature.

A high-precision measurement of the elastic electron-proton scattering cross section was performed at the Mainz Microtron MAMI with the multi-spectrometer facility. With a direct fit to about 1400 measured cross sections the form factors were determined with higher statistics and precision than previously known. The extracted proton rms charge radius is 0.879(8) fm [1].

With the spectroscopy of muonic hydrogen this radius was more accurately extracted to be 0.84184(68) fm [2] differing approximately 5 standard deviations from all other determinations. The confusing situation is known as the proton radius puzzle.

[1] J.C. Bernauer et al. (A1 Collaboration), Phys. Rev. Lett. 105, 242001 (2010)

[2] R. Pohl et al., Nature 466, 213 (2010)

Talk-28 (Nuclear Physics)

The 2^+ excitation of the Hoyle state in ^{12}C

Masatoshi Itoh

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Abstract:

The Carbon-12 nucleus has a state which plays an important role in the nuclear synthesis heavier than Carbon-12 in the universe, which is often referred to as the "Hoyle state". The structure of the Hoyle state is even now a matter to attract many theoretical/experimental nuclear physicists. Firstly, it was predicted to be a linear chain configuration of three alpha particles. However, its structure was found to be energetically unstable by the microscopic alpha-cluster model calculation. Now, the most approvable solution is that the Hoyle state has a dilute gas-like structure where three alpha particles are weakly coupled and spread as about twice of the ground state according to the alpha-cluster model.

One of methods to investigate the structure of the Hoyle state experimentally was to search the 2^+ excited Hoyle state in ^{12}C. We have performed inelastic scattering measurement in ^{12}C with 386 MeV alphas. By the extremely

forward angle measurement including 0 degrees and the multipole decomposition analysis, we have found the 2^+ excited state of the Hoyle state at Ex = 9.84 ± 0.06 MeV in ^{12}C. This newly found 2^+ state will be affected not only the study of the Hoyle state in nuclear physics but also the reaction rate of carbon creation in astrophysics.

In this presentation, besides many historical and latest researches on the Hoyle state, our experimental study of the 2^+ excited Hoyle state which is newly founded is presented.

Talk-29 (Nuclear Physics)

γ-ray spectroscopy of *sd*-shell hypernuclei at J-PARC

Takeshi Koike

Department of Physics, Tohoku University, Japan

Abstract:

Many atomic nuclei are known to posses stable non-spherical mass distributions or said to be deformed in their ground states. This is a well known example of a spontaneous breaking of rotational symmetry in nuclear system. It is of an unique and interesting theme to investigate a nuclear shape by looking at a dynamical response of nuclei as a whole to an addition of Λ hyperon with a strange quark. Experimentally, modern hypernuclear γ-ray spectroscopy with Germanium (Ge) detector arrays have achieved sensitivity to investigate such an effect. In this presentation, using Λ hyperron as a probe of a nuclear matter, an experimental idea to investigate a triaxial deformation of a normal nucleus via the γ-ray spectroscopy of a hypernucleus will be discussed for the *sd*-shell region. The combination of an intense beam from J-PARC and a new Ge detector array Hyperball-J is essential and will also be introduced.

Parallel Session C - Feb 21 - Mathematics

Talk-30 (Mathematics)

Coarse Baum-Connes conjecture for relatively hyperbolic groups

Tomohiro Fukaya

Department of Mathematics, Kyoto University, Japan

Abstract:

The Baum-Connes conjecture is a part of Connes' non-commutative geometry program. It can be viewed as a conjectural generalization of the Atiyah-Singer index theorem, to the equivariant setting, that is, the ambient manifold is not compact, but some compactness is restored by means of proper co-compact action.

Higson and Roe gave a further generalization of those conjectures to coarse geometry setting. Coarse geometry is

the study of metric spaces from a 'large scale' point of view.

Like the Atiyah-Singer theorem, the coarse Baum-Connes conjecture states that a topological object coincides with a purely analytic one. For given metric space X, the topological object is the coarse K-homology of X, while the analytic object is the K-theory of the C*-algebra associated with the space X, which is called Roe algebra.

The coarse Baum-Connes conjecture implies several other classical conjectures, for example, the Gromov-Lawson conjecture on the non-existence of a positive scalar curvature, the Novikov conjecture on the homotopy invariance of the higher signatures.

In this talk, I will report our results on the coarse Baum-Connes conjecture for a group which is hyperbolic relative to a finite family of infinite subgroups. We showed that the group satisfies the coarse Baum-Connes conjecture if each subgroup belonging to the family satisfies the coarse Baum-Connes conjecture and admits a finite universal space for proper actions. If the group is torsion-free, then it satisfies the analytic Novikov conjecture. This is a joint work with Shin-ichi Oguni.

Talk-31 (Mathematics)

Ergodic Theory of Painlevé VI

Takato Uehara
Mathematical Institute, Tohoku University

Most researches into Painlevé equations so far have been done from the viewpoint of integrable systems. However it can be shown that Painlevé VI is a chaotic dynamics in a difinitive sense. The sixth Painlevé equation $\mathrm{P_{VI}}(\kappa)$ is formulated as a holomorphic uniform foliation on a fibration of certain smooth quasi-projective rational surfaces

$$\pi_\kappa : \mathcal{M}(\kappa) \to Z := \mathbb{P}^1 - \{0, 1, \infty\},$$

which is transversal to each fiber of the fibration, where κ is a parameter. The fiber $\mathcal{M}_z(\kappa)$ over $z \in Z$ is called the space of initial conditions at time z. Since the foliation is uniform (Painlevé property), each loop $\gamma \in \pi_1(Z, z)$ admits global horizontal lifts along the foliation and induces an automorphism

$$\gamma_* : \mathcal{M}_z(\kappa) \to \mathcal{M}_z(\kappa),$$

which is called the Poincaré return map along the loop γ. One of the main results will state that γ_* always exhibits a chaotic behavior as long as γ is a non-elementary loop, where the adjective “chaotic” and the words “non-elementary loop” are defined in my talk.

Talk-32 (Mathematics)

Initial profile for the slow decay of the Navier-Stokes flow in the half-space

Takahiro Okabe

Mathematical Institute, Tohoku University, Japan

Abstract:

We consider the asymptotic behavior of the weak solutions to the Navier-Stokes equations in the half-space. Especially, we focus on the energy-decay problem of the Navier-Stokes flow in the half-space. In the whole space case, by the Fourier transform, the precise lower bound of the energy decay of the Navier-Stokes flow. In the half-space case, the decay estimate form above has been investigated. However the precise decay estimate form below was not known since the Fourier trans form does not work well. In this talk, we give a precise lower bound of the energy-decay and give the profile of the initial data which causes such a lower bound.

Talk-33 (Mathematics)

Higher eigenvalues of the Laplacian on a graph and partitions of the graph

Mamoru Tanaka

Mathematical Institute, Tohoku University

Abstract:

We can regard the 2-nd eigenvalue of the Laplacian on a connected finite graph as strength of connection between two disjoint subgraphs in the graph. In this talk, I will give a relation between the k-th eigenvalue of the Laplacian on a connected finite graph and the minimum among the 2-nd eigenvalues of the Laplacians on the subgraphs in a partition of the graph.

Abstracts of Poster Presentations

P-01

The spatial dispersion effect in stratified metal-dielectric metamaterial

Aunuddin Syabba Vioktalamo

Department of Physics, Tohoku University

Abstract:

The exotic electromagnetic response in typical metamaterial is attributed to the unusual inhomogeneous electromagnetic distribution in unit cell at particular frequencies. Therefore, the unit cell should small enough compare to wavelength which replaces the role of atom and molecule in conventional materials. But special unit cell design is not the only way to realize an inhomogeneous electromagnetic distribution.

Stratified metal dielectric metamaterial, or SMDM, is an artificial metal dielectric composite that consists of silver (30 nm) sandwiched by identical alumina (60 nm). Usually the optical response in optical frequency range is simply ascribed to the 1-dimensional photonic crystal effect, but we go to one further step to generalize the concept of effective medium to the structure with much larger unit cell size. We regard the artificial structure to be a hypothetical uniform material, which can be described in terms of effective permittivity and effective permeability.

The spatial dispersion is introduced to SMDM by investigating the average permittivity and average permeability of Maxwell's equation on the macroscale. The three cases are observed in different wave modes including propagation mode, pure plasma mode, and resonant crystal band-gap mode. We also compare the result with Transfer Matrix approach.

P-02

Resonance femtosecond stimulated Raman spectroscopy: development and application to vibration of excited state

Kenta Abe

Department of Physics, Tohoku University

Abstract:

In photosynthesis, carotenoids play important roles in light harvesting (LH) and photoprotective functions. The S_2 and S_1 excited states in carotenoids are important in the LH function. Recently, efficient energy transfer has been found from an excited state above S_1. The newly found state is named "hot S_1" according to assignment to a vibrational excited level of S_1. However, the dynamics and concerning vibrational mode have not been well understood. In this study, the vibrational dynamics of hot S_1 in β-carotene have been investigated by femtosecond

stimulated Raman spectroscopy (FSRS).

In FSRS experiment, the excited states generated by the first pump pulse were measured by stimulated Raman technique. The hot S_1 in β-carotene is generated by internal conversion from S_2 initially excited by the first pump (500 nm). The Raman spectra obtained by resonant and nonresonant FSRS are compared with numerical simulation of theoretical model. The hot S_1 is concluded to be the vibrational excited level of the ν_1 mode (C=C stretching).

P-03

Electronic State and Superconductivity of Heavy Fermion $CeRhSi_3$

Hiroki Iida

Department of Physics, Tohoku University

Abstract:

Since $CeCu_2Si_2$ was discovered as a heavy-fermion superconductor in 1979 [1], a number of heavy- fermion superconductors have been found. Their superconductivity appears in the vicinity of the border of magnetism in which a magnetic transition temperature goes zero. $CeRhIn_5$ is one of the typical heavy-fermion superconductors. The superconducting transition temperature T_c becomes maximum at the pressure where the antiferromagnetic order vanishes. An application of pressure suppresses the antiferromagnetic order and simultaneously induces the superconductivity. The effective mass of the conduction electron diverges at this pressure [2]. Interplay between the emergence of superconductivity and the critical phenomenon of the magnetism is an interesting issue for the heavy-fermion system.

$CeRhSi_3$ is a heavy-fermion superconductor found in 2005 [3]. Although pressure-temperature phase diagram of $CeRhSi_3$ is similar to that of $CeRhIn_5$, a critical behavior has not been observed thus far. In order to verify whether or not the effective mass diverges at a critical pressure, we have measured the electrical resistivity under pressure and magnetic field. In this symposium, we report the pressure and field dependences of the electronic state.

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[2] H.Shishido *et al*., J. Phys. Soc. Jpn. **74** (2005) 1103.

[3] N.Kimura *et al*., J. Phys. Soc. Jpn. **76** (2007) 051010.

P-04

Accurate Crystal Structure Analysis of $YTiO_3$ by Synchrotron X-ray Diffraction

Yoshihisa Ishikawa[1], Terutoshi Sakakura[1], Takahiro Nakano[1], Hiroyuki Kimura[1], Yukio Noda[1], Yasuyuki Takenaka[2], Syunji Kishimoto[3]

IMRAM, Tohoku University[1]

Hokkaido University of Education[2]

KEK – Photon Factory[3]

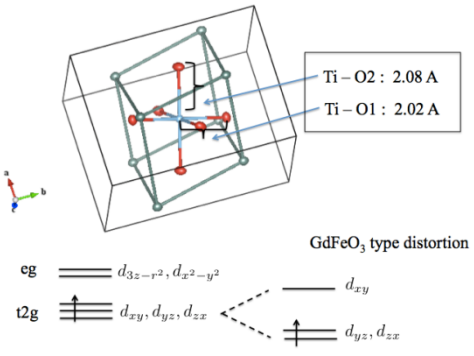
Abstract:

$YTiO_3$ is well known as one of orbital-ordering system materials. The orbital–ordaring phenomenon of $YTiO_3$ have many studied the both side of theoretical and experimental method. The crystal structure of $YTiO_3$ belong to a perovskite, Pbnm (Space group No.62 Pnma). The wycoff position of Ti atom is 4a and the site symmetry is -1. Figure 1 shows the crystal structure of yttrium titanate. $YTiO_3$ undergoes the phase transition from paramagnetic to ferromagnetic at Tc=28K. The aim of this experiment is to perform the accurate crystal structure analysis by Synchrotron X-ray Diffraction.

Single crystal of yttrium titanate was grown by floating zone method. And the cutting of the sample by marumerizer. The measurement is used the spherical sample of diameter 120μm.

We performed the Synchrotron X-ray diffraction at 4-circle diffractometer, KEK Photon Factory BL-14A. The incident wave length is 0.752A (d*/2 < 1.09). The measurement were performed four temperature 295K, 130K, 50K, 10K using He/N_2-gas blow.

All calculation by least Square refinement were performed using *JANA2006*, and Figure 2 shows the deformation electron density map around the Ti atom. We can observe Ti3d[1] orbital directly. Details of the results of structure analyses by multipole refinement method will be introduced in the symposium.



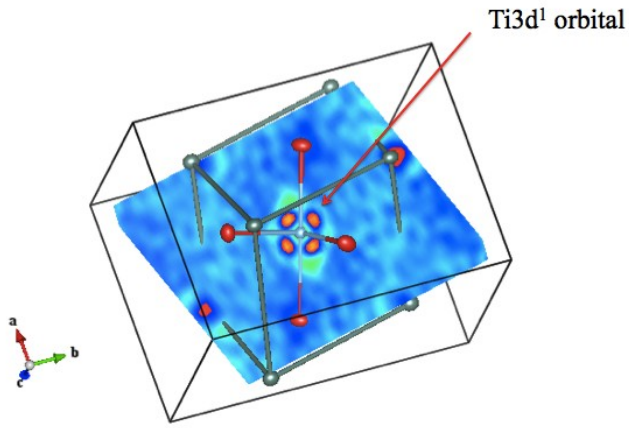


Figure 1. (Left) Crystal Structure of $YTiO_3$ (Space Gr. No.62 , P*nma* Setting)

Figure 2. (Right) Deformation Electron Density of $YTiO_3$

P-05

Terahertz Time Domain Spectroscopy of Dimer Mott Insulator

Keisuke Itoh

Department of Physics, Tohoku University

Abstract:

In some charge ordered (CO) compounds without inversion symmetry, dipole field induced by the CO is not canceled, resulting in the electron ferroelectricity[1-3] which enables us to expect ultrafast response in femtosecond time scale. Very recently, dielectric anomaly have been reported in triangular dimer Mott (DM) insulator κ-(BEDT-TTF)$_2$Cu$_2$(CN)$_3$[4]. Relaxer ferroelectric like enhancement in low frequency dielectric constant is attributable to the intradimer dipoles which are formed by the CO fluctuation (Fig.1). In the present study, optical and THz responses of this ferroelectric fluctuation was investigated by steady state THz spectroscopy and ultrafast optical pump-THz probe spectroscopy. In the steady state THz conductivity (σ_1) and dielectric constant (ε_1) spectra, broad peak (E//c) at ~1 THz region reflecting corrective excitation of the intradimer dipole was observed. This THz response is markedly increased by the photoexcitation, showing the photoinduced ferroelectric fluctuation. Such photoinduced ferroelectric fluctuation is quite different from the photoinduced melting of CO and ferroelectricity reported previously[5, 6]. The results will be discussed in terms of competition between the DM and the CO phases.

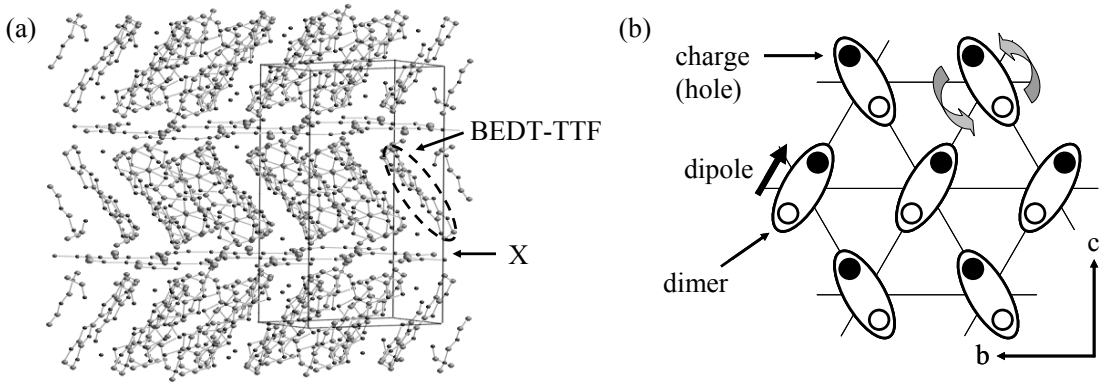


Fig.1 (a) Crystal structure and (b) Molecular arrangement of κ-(BEDT-TTF)$_2$Cu$_2$ (CN)$_3$. Dimer dipole in (b) is formed by charge disproportionation. Black and white circles illustrate charge rich and charge poor molecules, respectively.

[1] P. Monceau *et al*., Phys. Rev. Lett. **86**, 4080 (2001).

[2] K. Yamamoto, S. Iwai *et al*., J. Phys. Soc. Jpn. **77**, 074609 (2008).

[3] M. Naka, S.Ishihara et al., J. Phys. Soc. Jpn. **79**, 063707 (2010).

[4] M. Abdel-Jawad, T. Sasaki *et al*., phys. Rev. B **82**, 125119 (2010).

[5] S. Iwai, K. Yamamoto *et al*., Phys. Rev. Lett. **98**, 097402 (2007).

[6] Y. Kawakami, S. Iwai, K. Yonemitsu *et al*., Phys. Rev. Lett. **105**, 246402 (2010).

P-06

Investigating of the topological order in the quantum Hall effect

Toru Ito

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Abstract:

The fractional quantum Hall (FQH) state is the first discovered state that could not be characterized by symmetry breaking and local order parameters. It is long-standing problem that how to label and classify the orders in the FQH states. Recently, a new approach has been proposed to characterize FQH states using entanglement entropy. Kitaev and Preskill, and Levin and Wen showed the subleading contribution of the scaling law of the entanglement entropy in topologically ordered two-dimensional system. This contribution is boundary-independent universal correction called topological entanglement entropy. Here, we show numerical results of the calculating of the topological entanglement entropy for several types of the FQH states.

P-07

Structure of neutron-rich nucleus ^{31}Ne deduced from nuclear reactions

Yasuko Urata, Kouichi Hagino

Department of Physics, Tohoku University

Abstract:

Neutron-rich nuclei which have much more neutrons than protons are not stable against β-decays and do not exist in nature. Recent development of experimental techniques enables to synthesize and study such nuclei. Some neutron-rich nuclei have a spread density distribution, which is called halo and is a characteristic feature of neutron-rich nuclei. Nuclear halo structure can be experimentally investigated with nuclear reactions. To be concrete, large radii of halo nuclei enhance their reaction cross sections as well as Coulomb breakup cross sections. Therefore these reactions are powerful tools to study halo nuclei.

The halo nucleus discovered most recently is ^{31}Ne. It is understood that ^{31}Ne consists of the core nucleus ^{30}Ne and weakly bound one neutron which is spread out. When we regard the ^{30}Ne core as a spherical nucleus, however, the spread of neutron's wave function is not explained. Through this presentation, we assume the strongly deformed core ^{30}Ne and calculate the reaction cross section of ^{31}Ne taking into account its rotational excitation energy with particle-rotor model (PRM). We also calculate Coulomb breakup cross section with PRM. We will discuss the structure of ^{31}Ne deduced from the calculations for reaction cross section and Coulomb breakup cross section.

P-08

Oscillatory Instability of Slow Crack Propagation in Rubbers under Large Deformation

Daiki Endo

Department of Physics, Tohoku University

Abstract:

When a rubber balloon is ruptured, oscillatory crack patterns on a macroscopic scale are observed quite consistently. However, the mechanism of the oscillating instability is still not understood due to difficulty in treating a fast crack dynamics on which inertia is significant. Hence, if we could design an experiment where the crack propagation speed is quite reduced, we might be able to find an alternative approach to the oscillatory crack propagation in rubber films. Therefore, we propose a slow fracture experiment in which a rubber film is stretched and ruptured on a highly viscous oil. As a result, we have found an oscillatory instability of crack propagation when the applied uniaxial strain becomes smaller than a characteristic value. The transition from a straight pattern to oscillatory one arises around at a strain where strong nonlinear elasticity of the rubber film appears. We, therefore, expected that nonlinear elasticity may be a key factor for the crack pattern instabilities. To examine this expectation, we have conducted numerical simulations based on the neo-Hookean model showing the nonlineality at large strains. By comparing the results with those from the usual linear elastic model, we show the nonlinear elasticity is the essential factor to induce oscillatory instabilities.

P-09

Properties of proton-rich unstable nuclei and two-proton radioactivity

Tomohiro Oishi

Department of Physics, Tohoku University

Abstract:

Unstable nuclei have attracted a lot of interests in modern nuclear physics. These nuclei have a large neutron- or proton- excess and show exotic physical properties. In particular, "two-proton decay" is the most recently discovered decay mode of unstable nuclei beyond the proton drip-line. In the two-proton radioactivity, a parent nucleus emits spontaneously two protons and thus this can be regarded as a typical quantum-mechanical 3-body-problem. To explain theoretically the two-proton radioactivity, we need to take into account the pairing interaction between the two valence protons, Coulomb repulsion, continuum or resonant states, and the time dependence of nuclear system.

In this presentation we discuss basic properties of proton-rich unstable nuclei including a diproton correlation, soft dipole excitations and a role of Coulomb repulsion. Additionally, in order to investigate the dynamical two-proton decay process, we introduce the time-dependent basis-expansion method. Applying this method to the two-proton decay in a schematic 1-dimensional model, we will discuss the results for decay energy, width and

survival probability from initial state. We will also show the time-evolution of two-proton-density during the decay process.

P-10

Equilibrium States of Polymer-Containing Micelles

Yutaka Oya

Department of Physics, Tohoku University

Abstract:

Micelles and vesicles are closed form of membranes that are composed of amphiphilic molecules. They can carry some materials inside them. Polymer-containing closed membranes have been attracting attentions of researchers in bio- and industrial sciences. Typical examples are endocytosis and drug delivery system.

In a recent experiment, it was observed that equilibrium shape of an inverse micelle shows an anisotropic deformation due to the contained polymers. Since a micelle has in general spontaneous curvature, the micelle tends to show a spherical shape in its equilibrium state. When two micelles that contain polymers encounter, they fuse together to form a bigger one. In the present work, by introducing the effect of spontaneous curvature into a phase field model of membranes, we try to find the mechanism of the above phenomena based on simulation method.

P-11

Shot noise measurements for a Kondo-correlated quantum dot in the unitary limit

Yuma Okazaki

Department of Physics, Tohoku University

Abstract:

We demonstrate measurements of shot noise for the Kondo quantum dot, whose low-temperature conductance reaches the unitary limit value. Measured Fano factor is enhanced to 1.6 for a small bias regime, in which the dc conductance obeys the Fermi liquid formula. The value of the observed Fano factor agrees well with the theoretical prediction, and indicates that transport is mediated by a combination of one and two particle scattering processes. Additionally, we found unexpected logarithmic temperature dependence in the Fano factor for a large bias regime, in which the transport window exceeds the width of the Kondo resonance.

P-12

The analysis of Lambda hypernuclear spectroscopic experiment via (e,e'K^+) reaction at JLab Hall-C

Daisuke Kawama

Department of Physics, Tohoku University

Abstract:

We carried out the third generation hypernuclear spectroscopic experiment via (e,e'K^+) reaction at Jefferson Lab (US) in 2009. The goal of the present experiment is the hypernuclear spectroscopy in the wide mass region up to A=52. For this purpose, we newly designed the splitter magnet (SPL) for the charge separation of e' and K^+ and high resolution the scattered electron spectrometer (HES). The mass of hypernuclei is obtained by the missing mass calculated from the momentum of K^+, e' and electron beam. Since the design value of energy resolution of electron beam (2.344 GeV/c) is less than 10^{-4} and the momentum resolution of both K^+ spectrometer (HKS, central momentum 1.2 GeV/c) and HES (central momentum 0.84 GeV/c) is about $\Delta p/p=2x10^{-4}$, the energy resolution of missing mass is estimated to be less than 400 keV. The experimental targets used for the experiment are CH_2, H_2O, ^{7}Li, ^{9}Be, ^{10}B, ^{12}C and ^{52}Cr. CH_2 and H_2O targets are for the Λ and Σ^0 production whose masses are used for the missing mass calibration and the other targets are for the hypernuclear production.

The data analysis flow is divided into 3 main branches; i) Particle tracking, ii) Kaon identification, iii) Momentum calibration, and the i) and ii) were already established. For the momentum calibration, we used the known-mass peak of Λ/Σ^0. The hypernuclear peak of the $^{12}_{\Lambda}$B ground state, which was observed several times in the past experiments, was also used.

As a result of the calibration, we observed three hypernuclear spectrum, $^{12}_{\Lambda}$B, $^{7}_{\Lambda}$He and $^{10}_{\Lambda}$Be. From the spectroscopy of $^{12}_{\Lambda}$B, we confirmed its binding energies and cross sections are almost consistent with the results of the past experiments. This consistency indicates that our new experimental setup and analysis method were working fine. From the spectroscopy of $^{7}_{\Lambda}$He and $^{10}_{\Lambda}$Be, we discussed the CSB effect. In addition to these spectra, we confirmed the experimental setup worked for the ^{52}Cr target spectrum from the analysis of its data.

P-13

Coherent double pion photoproduction on the deuteron

Chigusa Kimura

Department of Physics, Tohoku University

Abstract:

Investigation of double pion photoproduction from the deuteron is useful in understanding the interaction between photon and bound nucleon. Since the deuteron consists of loosely bounded two nuclei, the quasi-free process is considered to dominate the photo-absorption process.

Non-quasi-free process, double delta productions from deuteron were observed in the previous study. These results

suggested the contribution of the non-quasi-free process is not small for the photoabsorption. The former and latter process corresponds to double delta production in the intermediate state and the coherent double pion production, respectively.

The experiment was carried out using tagged photon beams in the energy range of 0.8-1.1 GeV at the Research Center for Electron Photon Science (ELPH) with Neutral Kaon Spectrometer 2 (NKS2).
In this presentation, the current status of analysis will be reported.

P-14

Lambda hypernuclear spectroscopic experiment with the high quality electron beam at JLab

Toshiyuki Gogami

Department of Physics, Tohoku University

Abstract:

We have been performing Λ hypernuclear spectroscopic experiments by the (e,e′K^+) reaction since 2000 at Thomas Jefferson National Accelertor Facility (JLab). The (e,e′K^+) experiment can achieve a few 100 keV (FWHM) energy resolution compared to a few MeV (FWHM) by the (K^-,π^-) and (π^+,K^+) experiments. Therefore, more precise Λ hypernuclear structures can be investigated by the (e,e′K^+) experiment. In 2009, we performed the Λ hypernuclear spectroscopic experiment, E05-115 at JLab Hall-C. Data of $^{7}_{\Lambda}$He, $^{9}_{\Lambda}$Li, $^{10}_{\Lambda}$Be, $^{12}_{\Lambda}$B, $^{52}_{\Lambda}$V were taken successfully, and these data are been analyzed. This is the first attempt to access the medium heavy hypernuclei by the (e,e′K^+) experiment. I will show the latest analysis status of the experiment.

P-15

Electron microscopy and spectroscopy studies of organic molecules inside SWCNT

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Division of Electron Crystallography and Spectroscopy (Terauchi Lab)

IMRAM, Tohoku University

[1]*Department of Chemistry, Kinki University*

Abstract:

Polyynes are one-dimensional linear chains of carbon atoms with alternate single and triple bonds. They are usually unstable in air or in solution. However, polyynes trapped inside single-walled carbon nanotube (polyynes@SWCNT) are very stable which has been confirmed by Raman spectroscopy [1]. In our microscopy

studies of polyynes@SWCNT the high resolution transmission electron microscope (HRTEM) image and electron energy loss spectroscopy (EELS) of polyynes@SWCNT are presented [2].

Figure 1 shows HRTEM image of polyynes@SWCNT in which the line like contrasts, around 1 nm in length i.e. the typical molecular size of $C_{10}H_2$ polyyne, inside isolated SWCNT represent the existence of polyynes. It can be noticed that the distribution of polyynes inside nanotube is not homogeneous rather the nanotube is partially filled with the polyynes. It can also be noticed that, the polyynes here seem not perfectly straight rather in bending condition. The bending of polyynes perhaps due to the large diameter of SWCNT. As we would like to compare our experimental results with calculated one, in which the polyynes are considered as straight, so we are looking for thin nanotubes having straight polyynes. Figure 2(a) shows an area of an isolated SWCNT containing polyynes and figure 2(b) shows the EELS of the corresponding area. Figure 2(c) & 2(d) show the empty region of the same nanotube and eels data of the corresponding specimen respectively. The assignment of the peaks of those spectra is done with the help of Kataura plot in which the electronic transitional energies, E_{ii} (where i=1,2,3…), of SWCNT can be estimated with the value of inverse of diameter of the nanotube. It can noticed that both the eels spectra show similar nature which makes it difficult to identify the energy loss peak due to polyynes, however, an increased intensity from 2 eV to 7 eV, i.e. around π-plasmon energy region in figure 2(b) should be due to the inclusion of polyynes that is due to an increase of volume. The inter-band transitional energies E_{ii}, specially E_{11} and E_{22}, are quite prominent which makes it easy to index the nanotube chirality. For example, the eels in Fig. 2 might be from (17,0) zigzag nanotube.

We are also going to report the microscopic studies of coronene inside SWCNT.

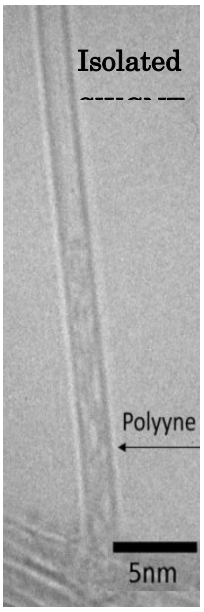

Fig.1 : HRTEM image of polyynes@SWCNT

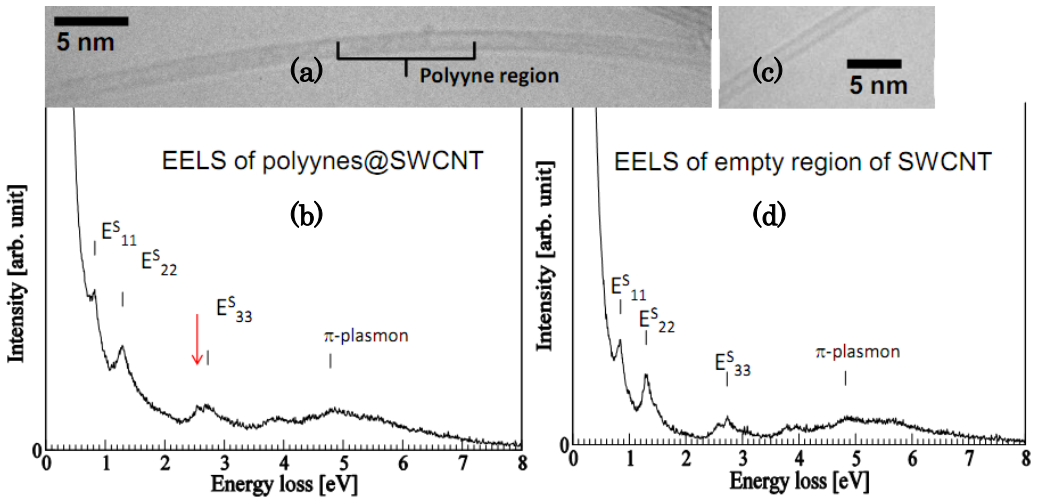

Fig.2: (a) Nanotube containing polyynes indicated by brace (b) EELS of the corresponding area of (a), (c) empty region of the same cnt of (a), (d) eels of (c).

[1] Nishide et al. J. Phys. Chem. C. Vol. 111, No. 13, 2007
[2] JPS meeting 2011, Sep 20-24, Toyama University, Toyama

P-16

New geometric interpretation of D-branes and DBI action

Shuhei Sasa
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Abstract:

Dirac-Born-Infeld (DBI) action gives the low-energy effective theory of a D-brane. It can be derived by calculating scattering amplitudes in string theory. However it is not obvious why DBI action. If some mechanisms characterize the effective theory of the D-brane and explain the reason why DBI action gives the effective theory, we may decide higher order corrections to DBI action without higher-order computation. As one such method, it is known that DBI action is invariant under the non-linearly realized Lorentz symmetry, which is broken by putting the D-brane on the target space. There, the scalar fields describing transverse displacements of the D-brane become NG bosons for broken translational symmetries.

In this poster, we give a new evedence for why DBI action by considering D-branes in the framework of generalized geometry proposed by Hitchin. in this framework, we show that the scalar fields and a gauge field on a D-brane can be treated in an equal footing and the argument about the non-linear realization of the spontaneously broken symmetries can be extended to include the gauge field and the NS-NS B-field.

P-17

Study of $B\to DK$, $D\to K_S\pi$ for the measurement of CP -violating angle ϕ_3, and $D^*\to D\pi$, $D\to K_SK\pi$ for the modeling of $D\to K_SK\pi$ Dalitz plane

Zenmei Suzuki
Department of Physics, Tohoku University

Abstract:

The measurement of CP-violating angle ϕ_3 is very important in terms of the verification of the Standard Model and search for new physics. However, the ϕ_3 accuracy is not so good, because $B\to DK$ decay that is used for ϕ_3 measurement is rare decay. This study is aimed for measurement of ϕ_3 using $B\to DK$, $D\to K_SK\pi$ (B, K, π : charged particle, D : D^0 or $\overline{D}^0$). There is not yet an effective result using this decay.

In the ϕ_3 measurement, the method using Dalitz analysis of $B\to DK$ is one of the most sensitive measurement, where $D\to K_Shh$ (h = K or π). $D\to K_Shh$ decay have many intermediate resonances, ϕ_3 is measured using the

interference between these resonances. We aim the measurement of ϕ_3 using $B\to DK$, $D\to K_SK\pi$, however, we have not understood the structure of $D\to K_SK\pi$. That is, we don't understand the distribution of resonances which are included in $D\to K_SK\pi$. It is difficult to extract that information from $B\to DK$, $D\to K_SK\pi$, because this decay has small statistics. Therefore, we study $D^*\to D\pi$, $D\to K_SK\pi$ to make the model of $D\to K_SK\pi$ Dalitz plane. This decay is so useful because of large statistics and the facility of distinction of D^0 and D^0.

We report the study of $B\to DK$, $D\to K_SK\pi$ and $D^*\to D\pi$, $D\to K_SK\pi$ decay to make the model of Dalitz plane of $D\to K_SK\pi$. When this analysis succeeds, the result is expected to be important for ϕ_3 measurement, decay of D, and involving resonances.

P-18

Description of single-Λ hypernuclei with relativistic point coupling model

Yusuke Tanimura

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Abstract:

Λ baryon, which has a quantum number of strangeness, has been attracting a lot of interest in nuclear and astronuclear physics, although ordinary matter surrounding us does not contain it. Nuclei which consist of not only protons and neutrons but also Λ are called *hypernuclei*. A way how a Λ particle affects a core nucleus when it is added to the normal nucleus has been studied both theoretically and experimentally. Response of a normal nucleus to addition of Λ may be essentially different from that to non-strange probes because Λ can penetrate deeply into the nucleus without the Pauli principle from nucleons. That is, Λ particle can be a unique probe of nuclear structure that is not seen in normal reactions. Such a peculiar effect of Λ on nuclei is called *impurity effect*. To access to structure information, we need to calculate the ground states of hypernuclei using, for example, relativistic Hartree or Hartree-Fock approximations.

In this work we construct a new model Lagrangian to describe nucleon-Λ interaction, which is to be employed in relativistic Hartree or Hartree-Fock calculations for single-Λ hypernuclei. Our model has various numerical advantages and is appropriate for heavy numerical calculations to investigate structure of hypernuclei and the impurity effect of Λ.

P-19

Boundary state analysis on the equivalence of T-duality and Nahm transformation in superstring theory

Yoshiro Teshima

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Abstract:

Superstring theory is the most attractive theory as the unified theory including gravity. General relativistic theory, which is described in Riemannian geometry, is well known as a classical theory of gravity. However, if we quantize general relativistic theory, we cannot remove divergence. But in superstring theory, the closed string propagation is consistent with graviton propagation. And the open string corresponds to gauge fields, so superstring theory is the strongest candidate of the unified theory including gravity.

However, the superstring theory is defined only perturbatively. To obtain nonperturbative definition, finding the background geometry is a effective way such as Riemannian geometry associated with general relativistic theory. Such geometry must have a T-duality. T-duality is the quantity that the circle with radius R is identical to the circle with radius α'/R. This quantity comes from the length of the string, so this is peculiar to string theory. So we have to know more about T-duality.

On the other hand, Nahm transformation is a transformation which transforms the gauge theory on a torus to the gauge theory on a torus with the inverse radius. So Nahm transformation is said to be related to T-duality. We investigated the correspondence of Nahm transformation and T-duality.

Nevertheless, it is shown that it agrees with the T-duality of the boundary state, including a minus sign. We reformulated boundary states in the RR-sector using a new representation of zeromodes, and show that the RR-coupling is invariant under the T-duality. Finally, the T-duality invariance at the level of the Chern-Simon coupling is shown by deriving the Buscher rule for the RR-potentials, known as the 'Hori formula', including the correct sign.

P-20

Statics and Dynamics of Wormlike Micellar Systems

Masatoshi Toda

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Abstract:

Surfactant molecules such as CTAB above the CMC self-assemble into long and flexible micelles in the presence of certain salts. Such micelles are usually called “wormlike micelles” and known to show pronounced viscoelastic properties due to the relaxation of intermicellar entanglements. For example, in the linear viscoelastic regime, they can show Maxwellian behavior with the single characteristic relaxation time. This behavior is very different from that of conventional entangled polymeric systems which always have a broad spectrum of the

entanglement relaxation modes. In addition, under steady shear flow, they can cause shear-induced phase separation called "shear banding". The microscopic origins of these interesting rheological properties have not yet been understood.

In order to investigate both structural and rheological properties of wormlike micellar systems, we have developed a particle-field hybrid model which describes micellar chains as discrete particles and a solvent part as a continuous field.

We will report several results obtained from computer simulations based on the above model.

P-21

Study of light hypernuclei with the Stochastic Variational Method

Yoji Nakagawa

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Abstract:

An ordinary nucleus consists of protons and neutrons, which further consist of up and down quarks. It is known that a nucleus with a hyperon(s) containing a strange quark(s), which is called a hypernucleus, can have some different properties from the core nucleus. Especially, properties of light nuclei may be drastically changed by adding a hyperon in it. For instance, the measured B(E2) value of $^{7}_{\Lambda}$Li is three times smaller than the corresponding value for the core nucleus. This reduction of B(E2) value is interpreted as a shrinkage of the distance between α and deuteron clusters in ^{6}Li.

One of the current topics in modern nuclear physics is concerned about neutron-rich nuclei. The first observation of the neutron-rich Λ hypernucleus, $^{10}_{\Lambda}$Li, was achieved in a KEK experiment. The evidence for the extremely neutron-rich Λ hypernucleus, $^{6}_{\Lambda}$H, was also reported from the FINUDA experiment at DAΦNE. In the near future, neutron-rich Λ hypernuclei, $^{6}_{\Lambda}$H and $^{9}_{\Lambda}$He, will be produced in the J-PARC E10 experiment. Therefore, it is timely to study the property of light neutron-rich hypernuclei.

In this presentation, I will show some calculated results for light hypernuclei obtained by using the stochastic variational method with correlated Gaussians, which is one of the calculation methods to solve nuclear few-body bound-state problems with the comparable accuracy to other approaches such as the coupled-rearrangement-channel Gaussian-basis variational method, and so on.

P-22

Study of $B^0 \to DK^{*0}(892)$ following by $D \to K^+ pi^-$ at Belle

Kentaro Negishi

Department of Physics, Tohoku University

Abstract:

We report on a study for $B^0 \to DK^0(892)$ decay with $K^{*0}(892) \to K^+ pi^-$. In this mode, B^0 flavor is tagged uniquely by $K^{*0}(892)$ decay. Our target is a measurement of the angle ϕ_3 from the ratio of the branching fraction for $B^0 \to DK^{*0}(892)$ following $D \to K^+ pi^-$ and $B^0 \to DK^{*0}(892)$ following $D \to K^- pi^+$. We use the full data sample collected at the $\Upsilon(4S)$ resonance with the Belle detector at KEKB accelerator.

P-23

DMRG study of the ground state phase diagram of interacting massless Dirac fermions in graphene under magnetic field

Tatsuya Higashi

Department of Physics, Tohoku University

Abstract:

Graphene is a two-dimensional carbon material with a honeycomb lattice and has massless Dirac-type low-energy spectrum. The relativistic nature of the low-energy dispersion relation of electrons in graphene strongly modifies the Coulomb interaction between electrons under magnetic field. In the present study, the ground state of the interacting massless Dirac fermions in a high Landau level (index N=2) is examined by the density matrix renormalization group (DMRG) method. The ground state energy, excitation gap, and pair correlation functions are systematically calculated at various fillings from ν=1/9 to 1/2. It is shown that the ground state phase diagram consists of incompressible quantum liquid, compressible liquid, and various types of charge density waves.

P-24

Cosmologically viable gauge mediation

Hiraku Fukushima

Department of Physics, Tohoku University

Abstract:

We followed the cosmological evolution of the coupled system of the supersymmetry breaking pseudo-moduli field and the messenger fields in a simple gauge mediation model which break supersymmetry at a meta-stable vacuum. We found a novel scenario that starting from the origin at high temperature, the pseudo-moduli field

successfully reaches the supersymmetry breaking meta-stable vacuum without coherent oscillation around the minimum. Thanks to the thermal potential term resulted from the thermalization of the messenger fields, the oscillation amplitude is extremely suppressed by the Linde mechanism. Then, there is no need to worry about the dangerous entropy / gravitino production by the decay of pseudo-moduli.

Also, thermal gravitino production is considerably suppressed once the messenger fields get thermalized. This is because at the temperature higher than the messenger mass, the most effective process to produce the gravitino is changed from the QCD process to the tree level scattering process including the messenger fields in the external line. The resulting gravitino abundance is determined by the temperature when the messenger fields become non-relativistic, independently of the reheating temperature. The observed dark matter density is explained by the thermally produced gravitino abundance, which is also consistent with the thermal leptogenesis as we can raise the reheating temperature high enough to produce the observed amount of baryon.

P-25

Study of Lambda photoproduction with Neutral Kaon Spectrometer 2

Takao Fujii

Department of Physics, Tohoku University

Abstract :

Strangeness photoproduction in the threshold region plays a unique role for the investigation of hadron interactions and their structure. Among the six isospin channels of the strangeness photoproduction, most of the experimental data have been obtained for the K^+ production channels. The experimental data for the reaction channels with K^0 was scarce because of their experimental difficulty, even though the data have been eagerly waited because they are expected to give the complementary information to the K^+ channels.

In order to observe the K^0 photoproduction, we built an electromagnetic spectrometer called as the Neutral Kaon Spectrometer 2 (NKS2) at Research Center for Electron Photon Science (ELPH), Tohoku University. The measurement of K^+ / K^0 and Λ photoproduction cross section with NKS2 has been performed using tagged photon beams around 1 GeV, and liquid Hydrogen and Deuterium target.

In this presentation, the current analysis status of this experiment about Λ photoproduction will be reported.

P-26

Statistical analysis of human written language

Sho Furuhashi

Department of Physics, Tohoku University

Abstract:

There are various probability distribution functions that characterize the statistical features of natural and social phenomena. For example, lognormal distribution is found in the size distribution of crushed rock and the income distribution of families, and gamma distribution is found in the lifetime distribution of electronic parts. The distribution forms depend on the mechanism of these phenomena.

In linguistics, writing style is a common research topic and has been studied by in various aspects. Statistical analysis is one of them. In statistical analysis, many quantities in texts are used to show the character of texts. Sentence length is one of such quantities and has been examined for many languages. In Japanese, some studies reported that sentence length distribution resembles a lognormal or gamma distribution. In order to explain the feature of sentence length distribution, some ideas were suggested. However, there have been no quantitative studies.

We examined sentence length using many Japanese sentences and investigated the mechanism of writing a sentence by utilizing dependency tree that represents sentence structure. The result indicates that, when we regard a segment as a unit of length, the length distribution of sentence elements such as subject and object follows exponential distribution. Sentence length which is the sum of the length of sentence elements basically exhibits gamma distribution. In this presentation, we will report the result.

P-27

Analysis of the hypernuclear γ-ray spectroscopy of $^{12}_{\Lambda}$C and $^{11}_{\Lambda}$B via the (π^+, K^+) reaction

Kenji Hosomi

Department of Physics, Tohoku University

Abstract:

The KEK-PS E566 experiment has been carried out at the KEK-PS K6 beam line from September to October in 2005. This experiment was proposed to study structure of $^{12}_{\Lambda}$C and $^{11}_{\Lambda}$B by high-resolution γ-ray spectroscopy technique. Employing the K6 beam line spectrometer and the SKS magnetic spectrometer, we produced hypernuclei via the 1.05 GeV/c (π^+, K^+) reaction. γ-rays from exited hypernuclei were detected by Hyperball2, large germanium detector array dedicated to hypernuclear gamma-ray spectroscopy. One of the purposes of this experiment is to measure the reduced transition probability $B(M1)$ of the Λ spin-flip $M1$ transition and to extract g-factor of a Λ in nuclear medium for the first time. Another purpose is to investigate the ΛN interaction further than our previous studies.

In this presentation, current status of data analysis will be reported.

P-28

Electrostatic potential analysis of ferroelectric phase of hexagonal $YMnO_3$ using convergent-beam electron diffraction

Daisuke Morikawa

Department of Physics, Tohoku University

Abstract:

A structure analysis method using convergent-beam electron diffraction (CBED), which was developed by Tsuda and Tanaka, enables us to directly determine the electrostatic potential from a nanometer-scale specimen area. The electron density distribution can be also obtained from the electrostatic potential through the Poisson's equation. We have applied the method to a hexagonal $YMnO_3$, which has ferroelectric phase at room temperature.

CBED experiments were conducted using a JEM-2010FEF transmission electron microscope equipped with an in-column omega-type energy filter. Intensities of electron diffraction were recorded on imaging plate. The accelerating voltage of electron microscope was 100kV. The CBED patterns were obtained at specimen temperatures of 300K. Atom positions, atomic displacement parameters and low-order structure factors were refined by nonlinear least-squares fitting between the experimental CBED patterns and dynamical diffraction calculations using an analysis software MBFIT. The electrostatic potential and electron density distributions were reconstructed from the refined parameters. From the anisotropy of the determined electrostatic potential and the electron density of Y-O bonds, the origin of the ferroelectricity is discussed.

P-29

X-ray exposure effect on charge-orbital order in Fe-doped layered manganites $La_{0.5}Sr_{1.5}Mn_{1-x}Fe_xO_4$

Yuki Yamaki

Department of Physics, Tohoku University

Abstract:

A single layered manganite $La_{0.5}Sr_{1.5}MnO_4$ shows charge-orbital order (COO) below T_{COO} = 240 K. We have investigated the impurity effect on COO state in this material and substituted Fe ions for Mn ions. In Fe-doped compound, it has revealed that not only transition temperature (T_{COO} = 140 K) and order parameter of COO decrease but also COO state is strongly suppressed by x-ray exposure at low temperature. In fact an intensity which reflects lattice distortion accompanied with COO decreases by x-ray exposure at 10 K. This measurement was performed with cooling from 200 K to 10 K without x-ray exposure. On the other hand, the intensity increases at 70 K in the same measurement condition. So these results indicate that COO state is suppressed at 10 K and enhanced

at 70 K by x-ray exposure. In this poster we report this x-ray induced effect in impurity doped manganite $La_{0.5}Sr_{1.5}Mn_{1-x}Fe_xO_4$.

P-30

Theory of Superconductivity in fullerides by the repulsive interaction model

Satoshi Yamazaki

Department of Physics, Tohoku University

Abstract:

Alkali metal doped fulleride (A_3C_{60}) forms very interesting class of the materials as a high transition temperature (T_c) superconductor. Especially, Cs_3C_{60} becomes Mott insulator at ambient pressure. This fact shows that A_3C_{60} is a strongly correlated system. On the other hand, Cs_3C_{60} becomes superconductor under applied pressure. We assume that this superconducting (SC) state is also caused by the Coulomb repulsive interaction. Using weak coupling approach, we study the SC state in A_3C_{60}. In this poster, we show that the anisotropic pairing appears in A_3C_{60}. The SC state has E_g symmetry in fcc model while it has T_g symmetry in bcc model. These SC states have 2 or 3 fold degeneracy, respectively at T_c. This degeneracy is due to three dimensional crystal structure of fullerides. Generally, this degeneracy must be split below T_c. One possibility is that the SC state with T_g symmetry becomes a chiral state. This state causes a small coherence peak in spin relaxation rate. This state is consistent with NMR experimental result.

P-31

Improvement of the detector systems for Neutral Kaon Spectrometer 2

Fumiya Yamamoto

Department of Physics, Tohoku University

Abstract:

The meson photoproductions is important for an understanding of the strong interaction between nucleons or quarks. In particular, the strangeness mechanism of production by electromagnetic interaction is not understood well yet.

We have been conducting experimental programs to study that with internally tagged photon beams at Research Center for Electron and Photon Science (ELPHs), Tohoku University. The Neutral Kaon Spectrometer 2 (NKS2), which was designed to observer neutral Kaons, are employed to measure the produced charged particles $\pi+\pi^-$, in the reaction process. The NKS2 spectrometer consists of dipole magnet with a diameter of 80 cm, a gap of 68 cm and a maximum magnetic field 0.42 T. The charged particles were measured by the drift chambers installed in the dipole gap and hodoscopes. A liquid deuterium target is located at the center of the dipole magnet.

Although the high quality data require reasonable trigger rate, large amounts of QED background makes the

higher rates to be difficult. In order to improve this situation, we tried to eliminate them at the trigger level by installing the lead glass Cherenkov counters on the beam plane. This counter can be identified the electron (or positron) and the charged π, because there is difference in behavior of those, the electron occurs electromagnetic shower. But, since charged π is also detected at this counter, it is not complete.

In this study, the analysis result of the electron-π identification and the evaluation of quality of trigger level QED background reduction with the lead glass Cherencov counters is reported.

P-32

Role of non-collective excitations in heavy-ion reaction around the Coulomb barrier

Shusaku Yusa

Department of Physics, Tohoku University

Abstract:

In heavy-ion reactions, there is a potential barrier between the colliding nuclei called Coulomb barrier. Nuclear reactions around the Coulomb barrier provide us with a good opportunity to investigate the effects of nuclear excitations on the reaction processes. This is because the nuclear excitations effectively modify the shape of the Coulomb barrier. In order to take into account the excitation effects, a coupled-channels method has been employed. Conventionally, a few collective excitations of the colliding nuclei have been considered in analyses, and successfully accounted for heavy-ion fusion reaction and quasi-elastic scattering experiments.

Recently, however, several experiments whose data cannot be accounted for by the conventional coupled-channels calculation have been obtained. One of the examples is the quasi-elastic scattering experiment for ^{20}Ne + $^{90, 92}$Zr systems. A standard coupled-channels analysis suggests the importance of the non-collective excitations for the description of these systems, which are not taken into account in the usual coupled-channels calculations.

In this contribution, we present the calculation for the fusion reaction and the quasi-elastics scattering for ^{16}O + ^{208}Pb system with including the non-collective excitations of ^{208}Pb. We choose this system because information on the non-collective states in ^{208}Pb has been experimentally obtained. We discuss the effect of non-collective excitations on the fusion and the quasi-elastic cross sections and barrier distributions.

P-33

Laser cooling of a GaAs/AlGaAs cantilever by exciton-related optical absorption

Takayuki Watanabe

Department of Physics, Tohoku University

Abstract:

Cooling of mechanical resonator is widely studied due to its importance in fields for basic research and practical applications. However, the temperatures required to cool mechanical resonators in its quantum ground state need ultra-low bath temperature which is difficult to be achieved. To overcome this difficulty, back-action or feedback control of mechanical resonator provides alternative means to reduce the mechanical mode temperature. To realize these effects, most techniques use auxiliary structures such as optical/electrical cavities or feedback circuits. In contrast to these approaches, we report cooling of a GaAs/AlGaAs heterostructure based cantilever via its electronic bandstructure which utilizes photon absorption. In this effect, a back-action force is created from carriers excited by a CW laser. We observe a change in the cantilever's thermal vibration with different laser power and we confirmed a reduction in the cantilever's mode temperature. We can also use this technique to measure a wavelength dependence of semiconductor optical property through mechanical resonance, because this back-action efficiency strongly depends on the optical absorption.

P-34

Magnetic properties of lightly electron doped $LaCoO_3$

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Department of Physics, Tohoku University, [A] KEK

Abstract:

The perovskite-type cobalt oxide $LaCoO_3$ is a unique electron system in terms of spin state. The Co^{3+} (d^6) ion exhibits spin-state degree of freedom: low-spin state ($t_{2g}^6 e_g^0$, $S = 0$), intermediate-spin state ($t_{2g}^5 e_g^1$, $S = 1$), and high-spin state ($t_{2g}^4 e_g^2$, $S = 2$), since the Hund's coupling energy competes with the crystalline electric field splitting energy between t_{2g} and e_g orbitals. By doping Sr^{2+} for La^{3+} (hole doping), $La_{1-x}Sr_xCoO_3$ exhibits interesting phenomena such as a huge magnetic moment (over 10 μ_B/hole) [1] and an insulator-metal transition [2], which are tightly related to the spin states. On the other hand, there are few reports of an electron-doped system compared with the hole-doped system. This is probably because that the standard expected electron-doped compound $La_{1-x}Ce_xCoO_3$ is difficult to synthesize. However, a new electron-doped compound $La_{1-x}Te_xCoO_3$ that is easier to synthesize has been recently reported [3]. In this presentation, the charge number of doped Te ions was estimated by X-ray fluorescence analysis method by using polycrystalline samples $La_{1-x}Te_xCoO_3$ (x = 0.01, 0.05). Magnetization measurements were also performed. We will compare the hole-doped and the electron-doped

systems in light of the spin states of Co^{3+}.

[1] S. Yamaguchi *et al*., Phys. Rev. B **53**, R2926 (1996).

[2] M. Kriener *et al*., Phys. Rev. B **69**, 094417 (2004).

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P-35

On the development of resonant inelastic x-ray scattering for high-pressure experiments

Masahiro Yoshida

Department of Physics, Tohoku University

Abstract:

Pressure is one of the most important external parameters along with temperature and magnetic field. By inducing pressure to a material, we can control its physical properties through shrinkage of the crystal lattice. While investigating the electronic structure is central to the understanding of physical properties, such studies are still hardly carried out due to the stringent conditions imposed by the use of high-pressure cells.

Resonant inelastic x-ray scattering (RIXS) is a powerful experimental method to investigate electronic excitations at finite momentum transfer. Because it is a photon-in-photon-out spectroscopy, RIXS can be applied to high-pressure experiments. So far, high-pressure RIXS experiments have only been performed on powder samples [1, 2]. Aiming to gain momentum resolution, we have performed a RIXS experiment on a single crystal subjected to high pressure for the first time. For this purpose, I introduced two optical components. One is Be lens for focusing x-rays and the other is a slit located after sample for removing the scattering x-ray from diamond. Then, I estimated their performance. In this poster, I will give an account of this instrumental development and present my high-pressure single-crystal RIXS data.

[1] - A. Shukla *et al.,* Phys. Rev. B, **67** 081101 (2003)

[2] - J.P. Rueff *et al.,* Rev. Mod. Phys., **82** 847 (2010)

P-36

Terahertz pulse shaping via difference frequency mixing of shaped optical pulses

Koji Uematsu

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Abstract:

Femtosecond pulse shaping techniques, which exist in wavelength range from visible to mid-infrared, have been developed for various applications, such as coherent control of matter and chemical reactions. In terahertz (THz) region, the use of intense sub-picosecond THz pulses provides tools in non-linear and time-domain THz

spectroscopy, but no efficient way for THz pulse shaping exists. Complex and precise control techniques of THz temporal waveforms are desirable for those applications.

In this poster presentation, I will demonstrate the controllability of THz waveforms via difference frequency mixing of shaped near-infrared laser pulses.

P-37

Spectral-Function Sum Rules in Supersymmetry Breaking Models

Mitsutoshi Nakamura

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Abstract:

The technique of Weinberg's spectral-function sum rule is a powerful tool for a study of models in which global symmetry is dynamically broken. It enables us to convert information on the short-distance behavior of a theory to relations among physical quantities which appear in the low-energy picture of the theory. We apply such technique to general supersymmetry breaking models to derive new sum rules.

P-38

Laser Raman spectroscopy and the *D* band of graphene

Nobuhiko Mitoma

Department of Physics, Tohoku University

Abstract:

Graphene is a candidate for new generation electronic devices. Although only 7 years have passed since the experimental realization of graphene, researchers on all over the world are investigating the material intensely. It was reported that it exhibits tremendously high charge carrier mobility; however, it cannot be used as a switching device, because it is a zero energy gap semimetal. To resolve the issue, fabricating graphene nanoribbons or chemical modification of graphene surfaces are widely known as solutions.

Laser Raman spectroscopy is known as a non-destructive tool for characterizing chemical and physical properties of graphene. However, our recent research revealed that graphene with water molecules exhibit nonnegligible photochemical reactivity under strong light irradiation.The *D* band is used as an index of defects induced on graphene. Graphene has high chemical reactivity in its edge region due to the existence of unpaired electrons; however, this photochemical reaction occurs even in non-edge region if water molecules exist there. Graphene field effect transistors were fabricated and their electron transport characteristics were measured. The mobility of graphene derivatives decreased compared to that of pristine graphene. These results imply the chemical modification of graphene surface by hydrogen or hydroxyl groups, which act as electron scatterers.

P-39

Theory of coherent phonon oscillations in carbon nanotubes and graphene nanoribbons

A. R. T. Nugraha and R. Saito

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Abstract:

We present a microscopic theory for the generation and detection of coherent phonons in single wall carbon nanotubes (SWNTs) and graphene nanoribbons (GNRs). Calculations are performed within a numerical extended tight binding model and analytical effective mass theory. In coherent phonon (CP) spectroscopy, ultrafast (sub-10 fs) laser pulses generate electrons and holes in the conduction and valence bands of a SWNT or GNR. If the pulse duration is less than the phonon oscillation period (20-100 fs), the photogenerated carriers couple to the phonons through the deformation potential electron-phonon interaction and the lattice undergoes macroscopic CP oscillations. The CP amplitudes satisfy a driven oscillator equation (derived from the Heisenberg equation) with a driving function that depends on the electron-phonon interaction matrix elements and the photoexcited carrier distribution functions. Coherent phonons are detected using a delayed probe pulse (up to 4 ps) to measure the time dependent oscillations in the differential transmission. Taking the Fourier transform of the differential transmission with respect to probe delay time, we obtain the CP spectrum as a function of phonon frequency with peaks in the spectrum corresponding to excited coherent phonon modes. In SWNTs and GNRs, the most easily observed CP modes are the so-called radial breathing mode (RBM) and radial breathing like mode (RBLM), respectively, in which the tube diameter and the ribbon width can initially expand or contract depending on their types and excitation energies. Such expansion and contraction simply originate from the 1D Brillouin zone properties of each SWNT and GNR type. This results in a family dependence of the CP amplitudes in SWNTs and armchair GNRs. In the case of zigzag GNRs, the so-called edge states play an important role in the generation of coherent phonons so that the CP amplitudes do not depend on the ribbon size.

P-40

High energy-resolution EELS and SXES studies on characteristic chemical shifts and charge transfer in Al-Si-Mn and Zn-Mg-Zr alloys

Shogo Koshiya

Department of Physics, Tohoku University

Abstract:

In recent years, Hume-Rothery mechanism, which predicts an existence of a pseudogap around the Fermi level E_F, is accepted as a major reason for the stabilization of quasicrystals. The presences of pseudogap in quasicrystals were confirmed by X-ray photoemission spectroscopy and electron energy-loss spectroscopy (EELS). EELS experiments also pointed out characteristic chemical shifts in Al L-shell excitation spectra of Al-based quasicrystals

[1], which suggested a decrease of valence electron charge at Al sites. Recently, a covalent bonding nature in approximant crystal, which is related to quasicrystalline alloys, was reported by MEM/Rietveld analysis [2]. Thus, it is interesting to investigate the relation between a chemical shift and bonding nature of the quasicrystalline materials.

In this study, the chemical shift of Al-Si-Mn alloys [3] and Zn-Mg-Zr alloys [4] including quasicrystalline phases were investigated by using EELS and soft-X-ray emission spectroscopy (SXES) and the amount of chemical shifts were compared with those of pure metals and oxides. Those results show a presence of characteristic chemical shifts, which implies the decrease of valence electron charge, not only in Al-based quasicrystals [5] but also in Zn-based quasicrystals [6]. Thus, a chemical shift can be a common characteristic in quasicrystalline states and valence charges of all atoms are decreased in quasicrystals. Therefore, it strongly suggests an increase of covalency in quasicrystal states.

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[2] K. Kirihara *et al.*, Phys. Rev. B64 (2001) p.212201.
[3] A.P. Tsai *et al.*, Phys. Rev. B49 (1994) p.3569.
[4] S. Ohhashi *et al.*, Acta Mater. 57 (2009) p.4727.
[5] S. Koshiya *et al.*, Phil. Mag. 91 (2011) p.2309.
[6] S. Koshiya *et al.*, Microsc. Microanal. 17 (Suppl. 2) (2011) p.1884.

P-41

Double Chooz: A search for the Neutrino Mixing angle θ_{13}

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Abstract:

It has recently been widely recognized that a reactor antineutrino disappearance experiment with two or more detectors is one of the most cost-effective ways to extend our reach in sensitivity for the neutrino mixing angle θ_{13} without ambiguities from CP violation and matter effects. The experiment, called Double Chooz, is planned to be sensitive to a $\sin^2 2\theta_{13}$ value down to 0.03 over a three year run with two detectors running simultaneously. This will cover roughly 85% of the currently allowed region. The Double Chooz reactor neutrino experiment offers the world particle physics community a relatively quick and inexpensive opportunity to measure the mixing angle θ_{13} if it is not too small: $0.19 > \sin^2 2\theta_{13} > 0.03$. The data taking is divided in two phases: a first one with the Far detector only (running since April of 2011), and a second phase with both Near (beginning of 2013) and Far detectors running simultaneously. For $\Delta m^2 \approx 2.5 \times 10^{-3} eV^2$, Double Chooz will be sensitive to 0.05 after 1.5 year of data taking in phase I, and 0.03 or better after 3 years of operation with two detectors. If θ_{13} is in this range, long-baseline off-axis neutrino experiments will be able to measure matter effects and search for CP violation. Further, a timely measurement of θ_{13}, available only from such an experiment, will be of considerable value in planning the more expensive off-axis accelerator projects, which are sensitive to matter effects and CP violation in the neutrino sector, but only if θ_{13} is large enough.

In this poster, the current status of the Double Chooz experiment will be reported as well as its first results.

P-42

Evidence for Quantum Magnetotransport of Dirac Cone States in $Ba(FeAs)_2$

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Abstract:

The observation of Dirac cone states in $Ba(FeAs)_2$ [1] opened up an interesting physical viewpoint in iron pnictide superconductors. Being the quantum state with high mobility carriers, Dirac cone states are more interesting in considering the quantum transport that arises from the quantization of the states under magnetic field B. We will report our observations on the dominant effects of Dirac cone states on the transport properties of $Ba(FeAs)_2$ [2] . In the B = 0 limit, the transport properties are governed by the Dirac cone states despite the small number of Dirac carriers. In a larger B, a B-linear transverse magnetoresistance up to B < 17 T was observed. This is consistent with the unique quantum transport of the 0th Landau level in a Dirac cone state [3]. Our results lead to a conclusion on the essential role of Dirac cone states in understanding the physics of iron pnictide superconductors.

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P-43

Research of Transmission-line STJ Detector for Terahertz Band

Kenta Takahashi

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Abstract:

Terahertz (THz) waves are electromagnetic waves with frequencies between high-frequency edge of the microwave band and the long-wavelength edge of far-infrared light. THz waves were non-development from difficulty of the generation and the detection, but a study of THz band advances in late years, THz band attracts attention in the field of industry and research.

We have proposed and demonstrated a new broadband and high efficiency THz wave detector using a superconducting tunnel junction (STJ). THz wave detection by photon-assisted tunneling (PAT) was usual with the conventional STJ detector, but our new detector uses the Cooper-pair breaking (CPB) mechanism for broadband detection. The detector consists of two log-periodic antenna wings connected with an impedance transformer and two long (transmission-line) STJs. The detector utilizes the excess tunneling current caused by the Cooper pair

breaking due to the radiation whose photon energy is greater than the energy gap of the used superconductor (around 0.7 THz for niobium). If the length of STJ is enough long compared with the mean free path of the emergent quasiparticles (~10 μm for niobium), the energy of THz waves is absorbed and we detect it. We have fabricated the device and performed the experiments for confirming the principle of this detector. We have succeeded the detection for the first time and the detector has sensitivity from 0.35 THz by the CPB and some peaks by PAT. We will present details of the detector and those results.

P-44

An investigation of the photoinduced production of strangeness in the threshold energy range

Brian O'neil Beckford

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Abstract:

The strangeness production processes by the electromagnetic interaction can be used as a probe to bestow indispensable information on the strengths of meson baryon cou- pling and internal structure of hadrons with the strangeness as a degree of freedom. High quality experimental data that have been obtained for the $\gamma p \rightarrow K^{+}\Lambda$ reaction at facilities such as CLAS and LEPS, are not sufficient to predict the cross section of the neutral channel. Thus, the investigation of K^{0} and Λ production near the threshold is the key to furnishing insight into the elementary strangeness production process. Furthermore, due to the uniqueness of the process in the neutral channel, it allows for the frontier of physics to be explored particularly concerning the experimental measurement of the photo-produced particles momentum and angular distribution. The motivation of the experiment lies on differentiating various channels contributing to strangeness photo production in the threshold region by specifically measuring the $d(\gamma, K^{0})\Lambda p$ reaction. An experiment using a tagged photon beam in the energy range of 0.90 -1.08 GeV in- cident on a liquid deuterium target was successfully performed. Its main purpose is to investigate the photoproduction process, particularly the production of neutral strange particles via single K^{0} and Λ measurement with acceptance less biased at the forward region compared with that of the NKS spectrometer. The generation of photo pro- duced particles was verified by the measurement of their decayed charged particles in the Neutral Kaon Spectrometer 2. The reconstructed invariant mass distributions were generated by selecting events where two or more particles tracks were identified. The details of the analysis method and preliminary results are of the experiment will be presented.

References:

[1] K. Tsukada et al.: Phys. Rev. C78 (2008) 14001.

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P-45

Simple model for rupture process of pressure-sensitive adhesives

Shinobu Sekine

Department of Physics, Tohoku University

Abstract:

Pressure-sensitive adhesives (PSA) are very useful in our ordinary life, which is a thin layer applied, for example, on the surface of tape film. Typical materials of PSA are made of block copolymers such as acrylates or styrene-isoprene-styrene (SIS) triblocks. They are usually very soft and highly dissipative, and can stick on a variety of surfaces under low pressure in short time without any solvent evaporation, heating process or chemical reactions.

We propose a simple mechanical model describing viscoelasticity and cavitation during the crack propagation process in pressure-sensitive adhesive. This model is originally proposed by Yamaguchi et,al,. They applied this model for probe-tack test, but their model is not applicable to the final rupture process. We extended this model to treat this rupture process, and applied to the situation of probe-tack test and peel test.

In this presentation, we will report our extended model and calculation results, and compare it with Yamaguchi's model.

P-46

Crystal growth of new target systems for high-energy neutron-scattering m Crystal growth of new target systems for high-energy neutron-scattering measurements at J-PARC

K. Tsutsumi[1], M. Enoki[1], K. Sato[1], Y. Ai[1] M. Matsuura[2], K. Yamada[3], and M. Fujita[2]

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High-T_C superconductivity in cuprate oxide emerges by doping sufficient charge carriers into an antiferromagnetic Mott insulator. For the last two decades, enormous efforts have been made to understand the mechanism of the superconductivity. Neutron-scattering measurement, which is powerful technique for the investigation of spin correlations, showed intimate relation between magnetism and superconductivity. An existence of spin excitation showing the similar hourglass-shaped spectrum in the different class of superconductors $La_{2-x}Sr_xCuO_4$ [1] and $YBa_2Cu_3O_{6+\delta}$ [2] suggests the importance of spin fluctuations for the appearance of high-T_C superconductivity.

To confirm the universal nature in the spin excitation spectrum by high-energy neutron scattering measurement, further systematic measurements on other class of high-T_C and adequate reference compounds are necessary. However, difficulties in growing sizable single crystal become bottleneck of the neutron-scattering study, since inelastic measurement requires large volume of sample over 1cc. We, therefore, attermpted to grow single crystal of several systems with the aim of investigation of entire spin excitation at a new facility such as J-PARC. In this conference, we will present recent progress of crystal growth of single-layer $Bi_{2+x}Sr_xCuO_{6+\delta}$, double-layer $La_{2-x}(Ca,Sr,Ba)_xCaCu_2O_{6+\delta}$, antiferromagnetic metal $La_{8-x}Sr_xCu_8O_{20}$ and so on, in our group. Preliminary results from neutron-scattering experiments performed on these new target systems will be also introduced.

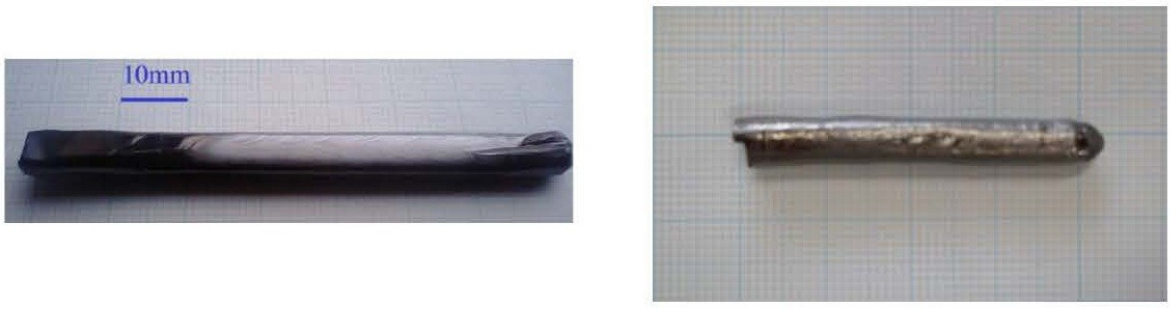

Figure 1. (a) Single crystal of single-layer $Bi_{2.4}Sr_{1.6}CuO_{6+\delta}$ (left figure) and antiferromagnetic metal $La_{6.4}Sr_{1.6}Cu_8O_{20}$ (right figure).

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P-47

A structural change of the vesicles in a nonequilibrium system including a chemically reacting system

Shinsuke Fukaya

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Abstract:

A living body system uses an amphipathic molecule etc. as a fundamental component. They are merely material. But they have such a feature of life by self-assembly. The reason is seldom known. This biological system which cannot be dealt with in the present thermodynamics ,linear non-equilibrium statistical physics and equilibrium statistical physics has a very interesting phenomenon. However, since there is no clear experiment models in this biological system , this field is not yet developed. In this study, we focused on Membrane shape changes caused by chemical environment which is one of the biological systems.

P-48

A uniformity test of BGO crystals to be used for an EM calorimeter

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Abstract:

We are constructing a 4π BGO electromagnetic (EM) calorimeter named BGOegg. It consists of 1320 BGO crystals, which are shaped as tapered blocks to make up an egg-shaped EM calorimeter. The scintillation lights of each BGO crystal will be read out through the back surface with a photomultiplier tube (PMT). If the light collection from every point along the path of an interacting particle is not uniform, the whole crystal will give different responses depending not only on the energy released but also on the position of the release. In other words, the amount of scintillation lights reaching PMT is affected by the shape of the BGO crystal.

In general, the position dependence of light output could be attributed to the optical properties of tapered crystals and reflectors with which the crystals are wrapped. The surface treatment by an etching method can make an improvement on the uniformity of the light output. In the present test, we are measuring the effect on the uniformity due to different surface treatments and wrapping reflectors for BGO crystals. Three different surface treatments and three kinds of wrapping reflectors shown in Table 1 have been tested.

In this presentation, we report the test results of longitudinal light output uniformity for each combination of surface treatment and reflector for BGO crystals.

Table 1 Surface treatments and wrapping reflectors for BGO crystals ※

Surface treatment	Reflector
Main *(Both front and back surfaces are polished while the lateral surfaces are etched)*	ESR *(3M Vikuiti™ ESR Enhanced Specular Reflector film)*
Polished *(All of the surfaces are polished)*	Aluminum foil
Etched *(Only the back surface is polished while other surfaces are etched)*	Tyvek *(DuPont™ Tyvek®)*

※ *The back surface is connected to PMT.*

P-49

Magnetic properties of potassium doped organic semiconductor: anthracene, tetracene, pentacene

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Abstract:

Recently, organic semiconductors have been applied to a variety of devices, such as organic field effect transistors (OFETs), organic light emitting diodes (OLEDs) etc. For realizing great improvement in performance of these devices, fundamental understanding of

organic semiconductors is very important. Polycyclic aromatic hydrocarbons are one of the most attractive series of organic semiconductors. Especially among them, anthracene, tetracene and pentacene are the most well known compounds. Although properties of the parent form as well as the doped phases with alkali metals of these materials have been studies by many researchers for long year, not only physical properties but also crystal structures in powder samples have not fully been unveiled until now. In order to have better understandings, high quality synthesis of a single phase of intercalation compounds is very important, because the physical properties are strongly dependent on the crystal structure.

We have tested different methodologies for synthesizing high quality powder samples of alkali metal intercalation compounds by employing potassium for anthracene, tetracene and pentacene. We have found a better synthetic technique, from the conventional solid-state reactions reported so far, for improving the crystal quality of potassium doped powder samples. The described method can give better homogeneity of the samples after intercalation. Our recent X-ray powder diffraction experiments on intercalation samples, prepared by a new method to be introduced in this meeting, show new stable phases. We will present how crystal quality can be improved and what magnetic properties can be observed from the powder samples prepared in the present new method.

P-50

Porting linux to MoGURA frontend electronics

Xu Benda

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Abstract:

MoGURA[1] is a DAQ system developed at RCNS for KamLAND experiment, with FPGA as its main IC and implemented with VHDL. In this work, we port embedded linux to the FPGAs as SoC[2], and realize a part of complex VHDL modules in software.

The advantage of software approach is ease of development and maintenance. While the advantage of VHDL approach is efficiency. A hybrid scheme is reasonable for a balance. Applications of this work includes data ethernet read-out and smart trigger.

P-51

Scanning tunneling microscopy of electronic properties of bulk and layered MoS2

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Abstract:

Reaching to dimensional limit of the conventional semiconductors, two dimensional electronic systems (2DES) are becoming more and more popular in nanoelectronic industry and being considered as the substitution of three dimensional devices. Miniaturizing the electronic devices does not only overcome the size limit but also provides more power efficient applications [1]. One of the suitable 2DES is a monolayer of molybdenum disulphide (MoS2) which has a direct band gap, Eg= 1.8 eV. Possessing this large band gap, enables to fabricate MoS2-based logic circuits [2] which is not feasible for zero band gap 2DES such as graphene. This direct band gap semiconductor was recently shown to become an indirect band gap semiconductor similar to the balk MoS2 (Eg = 1.2 eV) when the number of the layer is increased to 8 [3]. This was confirmed by optical spectroscopic techniques [4, 5]. In this work, using scanning tunneling microscopy (STM), we directly measured density of states of MoS2 to examine layer dependency of the band gap.

We examine the surface of the MoS2 bulk and visualize the distinct step structures. The step height is determined to be about 7 Å which is close to the thickness of the MoS2 monolayer (6.5 Å). We also measure the dI/dV curves which show a band gap of about 1 eV, comparable to the intrinsic indirect band gap of the MoS2 bulk (Eg = 1.2 eV). Thus, we identify the surface structure and density of states of the bulk. We will present the current status of STM experiments for the layered MoS2 as well.

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P-52

Quasinormal modes of charged anti-de Sitter black holes

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Abstract:

It is well known that rotating and/or charged black holes in asymptotically flat spacetime become unstable via superradiant scattering. Superradiance is a phenomenon that an impinging wave can be amplified by a rotating and/or charged black hole when the wave satisfies a certain condition. However, the quasinoraml modes o fthe black holes in asymptotically flat spacetime do not satisfy the superradiance condition.

For the black holes in asymptotically anti-de Sitter (AdS) spacoetime, it has been known that the rotating AdS black holes also become unstable if their quasinormal modes satisfy the superradiance condition when the black holes' radii are sufficiently smaller than the AdS scale. However, it is not well studied for the charged AdS black holes. Thus, we have investigated the quasinormal modes of the charged AdS black holes analytically and numerically in the small black hole limit, and showed that the charged AdS black holes become unstable against scalar perturbations if their quasinormal modes satisfy the superradiance condition.

P-53

The star formation in the SSA22 protocluster at z=3.09

Mariko Kubo
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Abstract:

At redshift > 2 − 3, several large scale high density region of galaxies which are thought to evolve into the present-day clusters of galaxies have been identified. The protocluster is the very suitable target for the detailed study of galaxy formation phenomena in the dense environment at high redshift. Among them, the SSA22 protocluster at z = 3.09 is known to be one of the most outstanding structure which was identified by the rest-UV selected star forming galaxies, Lyα emitters and Lyman break galaxies. The density excess of the galaxies based on their stellar mass, selected from rest-optical survey is also reported.

Therefore we studied the spectral properties of the rest-optical selected galaxies using rest-UV to MIR photometries. There are density excess of the IR-selected star forming galaxies. Their star formation rate are comparable to the ultra luminous infrared galaxies at local, and some of them also be detected at X-ray. These

results are good agreement with the formation scenario of massive ellipticals in the local cluster of the galaxies through gas rich merger. There also be the density excess of the evolved galaxies selected from their rest-UV to NIR color. We have ascertained the rapid formation of the galaxies in the high density region which was predicted from the hierarchical formations scenario of the galaxies in the ΛCDM cosmology.

P-54

Consistency Relation for Multi Field Inflation Scenario

Naonori Sugiyama

Astronomical Institute, Tohoku University

Abstract:

In early universe, the universe was expanding very rapidly. This expansion is called "Inflationary expansion" or just "Inflation". While it is well believed that the inflationary expansion certainly occurred, nobody knows about its physics in detail due to absence of accuracy of the cosmological observation. Therefore, many inflationary scenarios have been propounded. Recently, it is a most important topic of cosmology to constrain the several inflationary models from observation. In our latest work, the consistency relation which is a inequality satisfied in almost all inflationary models was derived. If the violation of the consistency relation is detected by the cosmological observations, then many inflation models with the consistency relation would be ruled out.

P-55

Path Integral Analysis of Bianchi I spacetime in Loop Quantum Cosmology

Kazuya Fujio

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Abstract:

We investigate Bianchi I Universe with massless scalar field and cosmological constant by using Ashtekar's path integral approach in the framework of Loop Quantum Cosmology (LQC). We obtain the effective action and approximation equations of this model, and copute the solutions. Although classical general relativity is good approximation in large scale, it is showed that quantum effect cause repulsive force in small scale to avoid the big bang singularity. Also the anisotropy is differ from classical trajectory. Because anisotropy has upper limit in LQC, the LQC anisotropy becomes larger or smaller than classical one.

P-56

The origin of low-luminosity AGN/AGN-like activity in red early-type galaxies

Takayuki Maebayashi

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Abstract:

In many galaxies, there are some active galaxies that exhibit enormous central luminosity, strong high-excitation emission lines, relativistic jet and so on. These active central regions are called active galactic nuclei(AGN). To unveil the co-evolutional history of host galaxy and its AGN, we must get precise pictures of all classes of AGNs. By the 1990s, the unified scheme, the physical picture of AGNs had been proposed. This scheme well explains many observational properties of high-luminosity AGNs. However, this cannot explain the properties of low-luminosity AGNs typically classed as the low-ionization emission line regions(LINERs). Therefore, we need to construct the low-luminosity AGN picture which also consists with the properties of its host galaxy.

One of the most powerful tools to investigate the physics of AGNs is emission-line diagnostics. Therefore, we examined the emission-line properties and their relations to host stellar mass and u'- r' color using early-type galaxy sample drawn from the Sloan Digital Sky Survey. In this poster, I will present the two main results: (1)The emission-line ratios of LINERs show the concentrated distribution on the diagnostic diagrams, (2)The host galaxies of these LINERs always have red color and not always have large stellar mass, and suggest that the possible ionizing mechanism of low-luminosity AGN/AGN-like activity in early-type galaxies.

P-57

Leaf-wise intersections in coisotropic submanifolds

Satoshi Ueki

Department of Mathematics, Tohoku University

Abstract:

J. Moser considered the leaf-wise intersection which is motivated by perturbation theory of periodic orbits for Hamiltonian systems. The leaf-wise intersection is a generalization of the Lagrangian intersection and the fixed point of Hamiltonian diffeomorphisms. Moser showed the existence of the leaf-wise intersections for Hamiltonian diffeomorphisms which is C^1-close to the identity.

A. Weinstein investigated the existence problem of Lagrangian intersection and reduced it to find zero points of some closed 1-form. In a similar way as Weinstein's argument, we replace the leaf-wise intersections by zero points of some closed 1-form, and show the same result as Moser's on the existence of leaf-wise intersections under different conditions.

After the first existence theorem by Moser, H. Hofer introduced the norm on the space of compactly supported Hamiltonian diffeomorphisms. He replaced the C^1-closeness assumption by the condition that the norm is smaller

than a certain symplectic capacity. He proved the existence of leaf-wise intersections for restricted contact type hypersurfaces in the Euclidean space. Recently, this result has been generalized by many mathematicians. In this presentation, we will introduce the example of these results.

P-58

Modified wave operator for the 2d nonlinear Schrödinger system with mass resonance.

Kota Uriya

Mathematical Institute, Tohoku University

Abstract:

We consider the asymptotic behavior of a solution to the quadratic nonlinear Schrödinger system in two space dimensions. For the single nonlinear Schrödinger equation, quadratic nonlinearities are border line between the existence of the scattering state or not. For the nonlinear Schrödinger system, mass of the particle may be effective to the asymptotic behavior of solution in addition to the order of nonlinearity. This is a distinctive phenomenon for the system. We show the existence of the modified scattering state under some condition of a mass.

P-59

The Law of the Iterated Logarithm for *G*-Brownian Motion

Emi Osuka

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Abstract:

The purpose of this study is a quasi-sure analysis of paths of *G*-Brownian motion. The law of the iterated logarithm (LIL) for *G*-Brownian motion is shown in Hariya-Osuka [2]. Another proof of LIL for *G*-Brownian motion is presented, whose procedure is as follows. First, we prove Schilder's type theorem for *G*-Brownian motion, that is, the upper bound of large deviations under the upper capacity, and the lower bound of large deviations under the lower capacity. The former is originally obtained by Gao-Jiang [1] through discretization; we employ a more direct approach. Next, we prove Strassen's LIL for *G*-Brownian motion. Our proof is based on the large deviation principle of Schilder's type and different from the original one given in Wu-Chen [3]. Finally, LIL for *G*-Brownian motion is shown as an application of the Strassen's LIL for *G*-Brownian motion.

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G-expectation. arXiv:1105.0135v1 [math.PR] 1 May 2011, 2011.

P-60

On elliptic surfaces related to Beilinson's Tate conjecture

Mariko OHARA

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Abstract:

We present examples of a rational elliptic surface over a field such that the complement of all fibers of split type I satisfies Beilinson's Tate conjecture for the second K-group but the boundary map arising from the localization sequense is not surjective. We consider the case that the base field is positive characteristic and transcendental over its prime subfield.

P-61

On Legendrian minimal submanifolds in Sasakian manifolds

Toru Kajigaya

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Abstract:

The notion of Hamiltonian-minimal (H-minimal) Lagrangian submanifolds in Kähler manifolds was introduced by Y.-G.Oh. This notion is a nice extension of minimal submanifolds. On the other hand, an odd-dimensional version of Kähler manifolds would be Sasakian manifolds in the contact geometry. Corresponding to H-minimal Lagrangian submanifolds, we introduce the notion of Legendrian-minimal (L-minimal) Legendrian submanifolds in Sasakian manifolds. Main concerns in these topics are the existence and the stability of these submanifolds. In this poster session, first we mention some relations between these two notions. Next, we give examples of L-minimal Legendrian submanifolds in Sasakian space forms, and determine its stability. Moreover, we prove the following Legendrian-unstability theorem in the unit sphere:

Theorem: There are no compact L-stable L-minimal Legendrian submanifolds in the unit sphere.

P-62

Calibrated Submanifolds

Kotaro Kawai

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Abstract:

The notion of calibrated submanifolds was introduced by Harvey and Lawson in 1982. In general, it is known by the Wirtinger inequality that the complex submanifold in a Kähler manifold minimize its volume in its homology class. Generalizing this property, calibrated submanifolds are defined. As examples, there are complex submanifolds in Kähler manifolds, special Lagrangian submanifolds in Calabi-Yau manifods, (co)assiciative submanifolds in G_2 manifolds, and so on.

The study of them is important in relation to mirror symmetry in physics due to the SYZ conjecture. This conjecture was presented by Strominger, Yau and Zaslow in 1996 and it explains mirror symmetry of compact Calabi-Yau 3-folds in terms of dual fibrations by special Lagrangian 3-tori, including singular fibers. Similar conjecture also exists for G_2 manifolds in terms of coassociative fibrations.

In this presentation, several ways to construct calibrated submanifolds are reported. Especially, using moment maps, special Lagrangian fibrations can be constructed.

P-63

Homogeneous Reinhardt domains of Stein in the complex n-space

Kouichi Kimura

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Abstract:

As is well known, Poincaré showed that there is no analytic isomorphism of the polydisc to the unit ball in the complex 2-space. This is sharp contrast to the Riemann mapping theorem in one complex variable, which is to say that analytic isomorphisms of several complex variables are considered to be very rigid. In order to generalize over this fact, Let us consider a domain in the complex n-space stable under rotations around the coordinate axis and called a Reinhard domain.

An analytic automorphism of the complex n-space except coordinate hyperplanes is said to be an algebraic automorphism, if whose components are given by Laurent monomials. Suppose an analytic isomorphism between two domains in the complex n-space is induced by an algebraic automorphism. Then it is called an algebraic isomorphism. Now we shall give an answer to the equivalence problem for bounded Reinhardt domains, i.e., if two bounded Reinhardt domains in the complex n-space are analytcally equivalent, then they are algebraically equivalent.

Therefore extending algebraically equivalence to unbounded cases, I want to classify homogeneous Reihardt domains of Stein and determine its canonical forms.

P-64

On the density of some sequences of integers

Rena Tateda
Mathematical Institute, Tohoku University

Define the excess of a positive integer n to be the difference between the total multiplicity and the number of distinct primes in the factorization. Let E_k denote the set of positive integers of excess k. We introduce that E_k has a density d_k and that sequence $\{d_k\}$ has a generating function given by

$$\sum_{k=0}^{\infty} d_k z^k = \prod_{p:\text{prime}} \left(1 - \frac{1}{p}\right)\left(1 + \frac{1}{p - z}\right),$$

and there is an analogue for polynomials over a function field.

Further, given $f \in \mathbb{Z}[x_1, .., x_l]$, we compute the density of $x \in \mathbb{Z}^l$ such that the excess of $f(x)$ is $k = 0$, assuming the *abc*-conjecture. This result also has the function field analogue.

P-65

On the formal group of the Jacobian

Tomonori Nakayama
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Abstract:
Let R be a commutative ring with the identity and denote by $R[[X]], X = (x_1, x_2, ..., x_n)$, the ring of formal power series in n variables with coefficients in R. An n-tuple of formal power series $F(X, Y) = (F_1(X, Y), ..., F_n(X, Y)), F_i(X, Y) \in R[[X, Y]]$, is called a formal group (or a group law) over R if $F(Z, 0) = F(0, Z) = Z$ and $F(F(X, Y), Z) = F(X, F(Y, Z))$. Formal groups have been very important tools in various branches of mathematics, especially in the theory of elliptic curves.

There are two explicit constructions of the formal group of an elliptic curve E. One uses the addition formula of E and the other uses the invariant differential of E. In 1968, Honda showed that a formal group can be constructed by the second method over $\mathbb{Z}$ and proved that the formal group is essentially isomorphic over $\mathbb{Z}$ to the formal group obtained by the first method, when E is defined over $\mathbb{Q}$. Recently, Freije generalised the second method for the formal group of the Jacobian of an algebraic curve. She also proved that the formal group is p-integral for all but finitely many p in the case of the modular curve $X_0(l)$, where l is prime.

P-66

On the enhancement to the Milnor number of a class of mixed polynomials

Kazumasa Inaba

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Abstract:

Mixed polynomials are polynomials in complex variables and their conjugates. M. Oka showed that mixed polynomials have Milnor's fibrations under the strong nondegeneracy condition. We study the enhancements to the Milnor numbers defined by W. Neumann and L. Rudolph, which is an invariant of the homotopy classes of fibered links in the sphere and belongs to integers. We calculate the enhancements to the Milnor numbers of a certain class of strongly non-degenerate mixed polynomials and show that all integers are realized by such mixed polynomials.

P-67

Heat kernel estimates for Markov processes associated with perturbed Dirichlet forms

Masaki Wada

January 31, 2012

Let $\{X_t\}_{t\geq 0}$ be a certain pure jump Markov process on $\mathbb{R}^d$ associated with the regular Dirichlet form $(\mathscr{E},\mathscr{F})$ on $L^2(\mathbb{R}^d,dx)$. We consider a positive Radon smooth measure μ satisfying some conditions and define the Schrödinger form by

$$\mathscr{E}^{\mu}(u,u) := \mathscr{E}(u,u) - \int_{\mathbb{R}^d} u^2 d\mu \quad (u \in \mathscr{F}).$$

Denote the generator of $\mathscr{E}^{\mu}$ by $\mathscr{H}^{\mu}$, i.e. $\mathscr{E}^{\mu}(u,u) = (\mathscr{H}^{\mu}u,u)$ and let h be a positive harmonic function with respect to $\mathscr{H}^{\mu}$. By means of Doob's h-transformation and heat kernel estimates obtained by Chen and Kumagai et al., we can conclude that the fundamental solution of $\frac{\partial u}{\partial t} = -\mathscr{H}^{\mu}u$ has the same two-sided estimates as the transition density function of original $\{X_t\}_{t\geq 0}$ does.

P-68

Location of the concentration point in the ground-state solution of a reaction-diffusion equation in a heterogeneous medium

Hiroko Yamamoto

Mathematical Institute, Tohoku University

Abstract:

A. Gierer and H. Meinhardt proposed a reaction-diffusion system comprised of an activator and an inhibitor as the morphogenetic model of organisms. It is postulated that biological pattern formation is governed by chemical pattern resulting from the interaction between the activator and the inhibitor. Their model is controlled by a 2x2 system of nonlinear parabolic PDEs, and it generates various types of patterns. Among them the most noticeable is a point-condensation phenomenon by which we mean that the activator concentrates in a very narrow region around a finitely many points, forming a spike-like pattern.

When the diffusion of the inhibitor is infinitely fast, the stationary problem is reduced to a Neumann problem for a semilinear elliptic equation with a basic production term which does not contain the unknown function. The standard variational method gives us the least-energy solution, or the ground-state solution, of this Neumann problem. It turns out that the ground-state solution concentrates at exactly one point when the diffusion coefficient of the activator is sufficiently small. Since biological pattern formation takes place often in heterogeneous media, it is very important to know the effect of heterogeneity on the location of concentration point. In this poster we are interested in how to express the location in terms of the coefficients appearing in the equation.

P-69

Weak Determinacy of Infinite Games and Corresponding Hierarchy of Inductive Definitions

Keisuke Yoshii

Abstract

The purpose of this research is to investigate the logical strength of weak determinacy of Gale-Stewart games from the standpoint of reverse mathematics. Reverse mathematics is a program to determine which set existence axioms are required to prove a mathematical theorem, and it is known that most of classical theorems are equivalent to few axioms from weaker to stronger, $\mathsf{RCA}_0, \mathsf{WKL}_0, \mathsf{ACA}_0, \mathsf{ATR}_0$, and Π^1_1-CA_0, called as Big 5.

It is obvious that there are much stronger axioms than Π^1_1-CA_0, but it had not been known much about them. To this question, K.Tanaka in 1991 introduced that Σ^1_1 inductive definition, known as important concept in descriptive set theory, as stronger axioms than Π^1_1-CA_0 and also showed that Σ^0_2 determinacy is equivalent.

Recently, much effort has been made to characterize the determinacy of game classes above Σ^0_2 within second order arithmetic. In this presentation, we explain the recent strudies of this field, the new result obtained in our research, and how our future works will be.

P-70

On the orbit space of certain prehomogenous vector spaces

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Let k be fixed an arbitrary field, G be a connected reductive group and V a representation of G, both defined over k. We say that a couple (G, V) is a **prehomogenous vector space (P.V.)** if there exist a Zariski open orbit. If (G, V) is a P.V., V is single orbit over $\overline{k}$ in general. But V is not necessarily single orbit over k, and it is difficult and interesting problem to describe the orbit space V_k/G_k explicitly. An arithmetical meaning of the orbit space of P.V.'s state as follows: First, we denote $\mathscr{E}x_i$ to be the set of isomorphism classes of Galois extensions of k which are splitting fields of degree i equations. Then, for $i = 2, 3, 4, 5$, it is known that there is bijective correspondence between $\mathscr{E}x_i$ and V'_k/G_k for suitable P.V.'s (V' will be a set of "general points" of V). **Roughly speaking, the concept of P.V. give us a way to realize "the parametrization of fields".** In this poster session, we try to review the above results by using elementary method.

P-71

The characterization of a pinned polymer

NISHIMORI, Yasuhito
(Mathematical Institute Tohoku University)

We consider a polymer as a trajectory of a Markov process. Let $(\{B_t\}_{t\geq 0}, P_0)$ a 1-dimensional Brownian motion with starting at origin and $L_t = \int_0^t \delta_0(B_s)ds$ the local time at origin. Define a Gibbs measure as

$$dP_{\beta,t} = Z_{\beta,t}^{-1} e^{\beta L_t} dP_0, \quad Z_{\beta,t} = E_0\left[e^{\beta L_t}\right],$$

where a parameter $\beta > 0$ is the inverse temperature. When there exists some $\kappa > 0$ suth that

$$\lim_{t\to\infty} P_{\beta,t}\left(\frac{L_t}{t} > \kappa\right) = 1,$$

it is said that a polymer is "*pinned*". We extend the above case of the Brownian motion and the local time to the symmetric α-stable process on $\mathbb{R}^d$ and a positive continuous additive functional which is in the Revus correspondence with some smooth measure, respectively.

We assume $\alpha < d \leq 2\alpha$. Our claim is that if $d \geq 3$ then there is a $\beta_{cr}(d)$ such that for every $\beta > \beta_{cr}$, the polymer is pinned, but for any $0 < \beta \leq \beta_{cr}(d)$, is not. And the critical inverse temperature $\beta_{cr}(d)$ is determined by the spectral bottom of the Schrödinger type operator.

P-72

Asymptotic Behavior of Non-local Feynman-Kac Semigroups

Masakuni MATSUURA*

January 30, 2012

We have studied the asymptotic behavior of non-local Feynman-Kac semigroups of pure-jump symmetric stable processes on $\mathbb{R}^n$ from the viewpoint of the theory of probability. We have solved the Feynman-Kac penalization problem by using Girsanov transform.

We give concrete examples of jumping functions with the full support in the Feynman-Kac functional. Lévy system and Green function of symmetric stable processes are well known.

We also find the asymptotic behavior of non-local Feynman-Kac semigroups and the growth of the L^p-spectral bound of them. They differ according to the value of the bottom of the spectral function and the $L^2(dx)$-integrability of the ground state of the Schrödinger type equation perturbed by Kato class measures.

P-73

Network Games with and without Synchroneity

Ahmad Termimi Ab Ghani

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Abstract:

To formulate a network security problem, Mavronicholas et al. (2005) introduced a strategic game on an undirected graph whose nodes are exposed to infection by attackers, and whose edges are protected by a defender. Subsequently, MedSalem et al. (2007) generalized the model so that they have many defenders instead of a single defender. Then, we introduced a new network game with the roles of players interchanged, and obtained a graph-theoretic characterization of its pure Nash equilibria (Termimi & Tanaka, 2011). In this presentation we study mixed Nash equilibria for stochastic strategies in this new game, and then we generalize our network game to an asynchronous game, where two players repeatedly execute simultaneous games. Although the asynchronous game is formally an infinite game, we show that it has a stable solution by reducing it to a finite game.

P-74

An ODE-diffusion system modeling regeneration of Hydra

Madoka Nakayama

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Abstract:

Hydra is a small animal living in fresh water, which is best known for its ability of regeneration. When a hydra is cut into two pieces, two hydras will regenerate. There have been several mathematical models proposed to describe this experiment. For example, Gierer and Meinhardt (1972) proposed a reaction-diffusion model consisting of a slowly diffusing activator and a rapidly diffusing inhibitor. The activator plays role to promote head regeneration while the inhibitor supresses the production of activator so as to stabilizes the system.

We consider a model proposed by Marciniak-Czochra in 2006, which is based on the receptor-ligand dynamics. The basic idea of this ODE-diffusion system is as follows: Each cell has receptors on its surface. A receptor functions as a switch of a chain of reactions that stimulates the formation of head. When diffusive ligands are bound to a receptor, the switch is turned on. Hence a head is formed at the place of higher receptor density. The model consists of the densities of free receptors, bound receptors, ligands and the production rate of ligands. The characteristic of this model lies in that the density of ligand is a only variable which diffuses. We consider (i) the existence and boundedness of solutions, (ii) the range of initial values of solutions that converge to constant stationary solutions, and (iii) construction of monotone increasing stationary solutions in a one-dimensional domain for all values of coefficient of ligand.

P-75

Periodic decomposition of functions holomorphic in domains containing convex polygons

Takanao Negishi

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Abstract:

We give some applications of A. F. Leont'ev's results on periodic decomposability of functions holomorphic in convex polygonal domains. First we consider meromorphic periodic decompositions of holomorphic functions on a closed convex polygonal do main which has no parallel sides, i.e., representations of functions holomorphic in such a polygonal domain as a sum of meromorphic periodic functions. This is extendable to meromorphic periodic decompositions of meromorphic functions.

Second we consider holomorphic functions on more general domains which are not necessarily convex polygons. Under some conditions on domains, Leont'ev's theorem is extendable to periodic decompositions of these functions.

P-76

Lower bounds of the canonical heights on certain elliptic curves

Tadahisa Nara

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Abstract:

We compute a lower bound of the canonical height on quadratic twists of certain elliptic curves. Using the lower bound, we show that an explicit rational point on an elliptic curve is primitive, as an element of the Mordell--Weil group.

P-77

Relative Randomness for Martin-Löf random Sets

NingNing Peng

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Abstract. In the literature, various randomness notions have been introduced for different motivations. The most commonly accepted one is Martin-Löf randomness. In this presentation, we study the randomness notions stronger than Martin-Löf-randomness. Because randomness notions weaker than Martin-Löf randomness have unusual properties and are often not, at least in my opinion, considered as real randomness, we focus on the stronger ones. A main purpose of this presentation is to give a general framework for such stronger randomness notions. To do this, we introduce the notion of semi Γ-randomness.

Let Γ be a set of functions on the natural numbers, the semi Γ-randomness is associating with a Γ-indexed test. Fix a computable sequence $\{G_n\}_{n\in\mathbb{N}}$ of all c.e. open sets. For any $f \in \Gamma$, $\{G_{f(n)}\}_{n\in\mathbb{N}}$ is called a Γ-indexed test if $\mu(G_{f(n)}) \leq 2^{-n}$ for all n. We prove that weak n-randomness is strictly stronger than semi Δ^0_n-randomness. Moreover, we investigate the relationships between various definitions of randomness.

On the other hand, we also prove some general properties of Γ-randomness, which is a randomness notion much stronger than semi Γ-randomness.

P-78

Smoothness of densities of generalized locally non-degenerate Wiener functionals

Nobuaki Naganuma

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Abstract:

Several criteria for existence of smooth densities of Wiener functionals are known in the framework of Malliavin calculus. In this presentation, we introduce the notion of generalized locally non-degenerate Wiener functionals, and prove that they possess smooth densities. The advantage of the result is as follows:

1. It requires functionals themselves to have only the first order derivative.
2. It does not requires the determinant of Malliavin covariance matrix to have negative moments.

The result presented here unifies earlier works by Shigekawa and Florit-Nualart. To obtain the result, we prove integration by parts formula under the generalized local non-degeneracy condition.

P-79

Viscosity solutions on a Riemannian manifold

Abdullah Kizilay
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Abstract:

The theory of viscosity solutions in $\mathbb{R}^N$ has been an important area in analysis since the concept was introduced in 1980's by M. Crandall and P.-L. Lions. As a generalization of the classical concept, the viscosity solution is a natural solution in many applications of PDEs. Mainly, they work in the Dirichlet problem [DP]: $F(x, u, Du, D^2u) = 0$ with certain boundary condition and Cauchy-Dirichlet problem [CDP]: $u_t + F(t, x, u, Du, D^2u) = 0$ with a boundary condition and an initial condition at time $t = 0$. The theory usually needs the following tools and steps:

(i) Second order subjet (and superjet).
(ii) Properness of F: Degenerate ellipticity and nondecreasing in u term.
(iii) Comparison principle (to show the uniqueness), and Perron's method (to show the existence)

Now, It is natural to ask how to generalize the theory for problems in Riemannian manifolds. The motivation lies in the recent works of D. Azagra, J. Ferrera, B. Sanz in 2008, and X. Zhu in 2010. They mentioned a general setting, and under suitable condition, they give a sketch of the proof of a similar fact in this general setting for [CDP].

In this presentation, following their method, we present the theory of viscosity solutions to parabolic PDEs on a Riemannian manifold. The key idea for the extension of the theory of viscosity solutions in the Euclidean space to Riemannian manifolds is a use of special charts, namely the normal coordinate using exponential maps.

P-80

The rationality of the Precautionary principle: making the precautionary principle more applicable

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Abstract:

We cannot obtain full knowledge of future events; thus, we must base our risk analysis and management on probabilistic or statistical approaches and assess the likelihood of an event's occurrence probabilistically or statistically.

However, there are some realms of science in which we cannot use such approaches due to a lack of sufficient scientific knowledge with regard to complex phenomena, such as global warming. We must, nonetheless, make decisions in circumstances in which insufficient knowledge of possible high risk events compromises the reliability of scientific analysis.

In order to cope with such uncertainty and evade catastrophic disasters, we need to introduce a "precautionary principle", requiring us to adopt approaches such as regulating or banning the use of certain chemical substances or technologies in order to protect human health and the environment despite a lack of sufficient scientific certainty.

Some doubt the applicability of the precautionary principle, claiming that it lacks a rational basis and may thus lead to irrational conclusions. This might suggest that we cannot make public policy decisions in by means of the precautionary principle alone. Accordingly, it is necessary to reconsider the precautionary principle from the viewpoint of "risk communication".

In this presentation, I would like to examine the notion of "rationality" and to emphasize the implications of "deliberative democracy" with regard to the better application of the precautionary principle.

P-81

Hume on Logic and Demonstration

Hiromichi Sugawara

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Abstract:

The 18th century Scottish philosopher David Hume presented four relations as objects of our knowledge and certainty. These were resemblance, contrariety, degrees in quality, and proportions in quantity or number. Basically, according to him, these relations are intuitively certain, except equality or any exact proportion in the latter of the relations (proportions in quantity or number). Even leaving aside the question of what "intuition" might be, it would seem likely that the term being simply understood straightforwardly and non-analytically would before long invite doubt and criticism to Hume's argument. The reason being, simply, that one might easily imagine that we all have different points of view regarding qualities or resemblance. The more significant and problematic relation is, however, the last one, especially regarding the demonstration of its certainty.

In this presentation, I focus on the relation of proportions in quantity and number, and attempt to develop a clear explanation of that relation. I take the following perspective to be a key to the clarification of this aspect of Hume's thought. Hume has benefitted from the work of Descartes, Locke, A. Arnauld and others in attaching greater importance to the contents of ideas than the form of arguments, this having developed via the Scholastic Logic. This is reflected in Hume's attack on the logic taught in schools at that time. Modern logic and syllogism before Descartes, both of which valued form, pose difficulties in understanding the problem stated above. Nonetheless, the essential fact is that Hume regarded the only aim of Logic as being *'to explain the principles and operation of our reasoning faculty, and the nature of our ideas.'*

P-82

The problem of the relationship between individuality and universality in Hegel's philosophy

Yuusuke Minegishi

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Abstract:

The treatment of the problem of subjectivity in the work of Hegel throws on the relation between individuality and universality from the viewpoint of modern German philosophy. That relation had been a topic of keen debate since medieval times. In one of his chief works, "Wissenschaft der Logik"; Hegel advances a motif quite peculiar to his thought: the "personality of the concept". This does not imply the rendering of philosophy into a form of anthropology. He intends to lay the foundation for the person-motif, which was formed as a philosophical motif by way of Christian theology (for example via Augustine's trinity theory), metaphysically rather than ethically or practically.

In my presentation, I make reference to the philosophy of Nicholas of Cusa (1401~64) for the purpose of gaining a wider view of the metaphysical significance of the person motif. Nicholas tells us that the individual is, though limited as an individual, nonetheless unlimited as part of the totality. Bringing in his thought offers us a new perspective on one of the most important motifs in Hegel's philosophy: totality.

P-83

Prolegomena revisited

Masatoshi Echigo

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Abstract:

This paper deals with Husserl's 'Prolegomena', from his 'Logical Investigations'. In the 'Prolegomena', he opposes the psychological interpretation of logic. He also denies relativistic arguments about truth and defends the general structure of sciences. In the course of this defense, he focuses his attention on Protagorean relativism. This form of relativism claims that the individual man is the measure of all things. Thus all truth is relative to the judging subject, and what is true is true only to the individual man. Husserl thinks that criticizing this form of relativism is of key importance to achieving his aim. This paper tests Husserl's criticism of relativism, considers whether the criticism is relevant to the essence of relativism, and poses the question of whether or not a relativism which the criticism cannot deny might remain. This paper is, in effect, an appreciation of the significance of the 'Prolegomena'. The final aim of this paper is to clarify the role which the 'Prolegomena' plays in the 'Logical Investigations', and to assess the influence which 'Prolegomena' had on the development of Husserl's later thought.

P-84

On the Myth-Making Function in Bergson

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Abstract:

The purpose in this study is to compare ‘‘the myth-making function’’ (la fonction fabulatrice) in Henri Bergson with psychological imagination in Théodule Ribot and to examine the originality of the myth-making function. The myth-making function is dealt with in Bergson's last book, The Two Sources of Morality and Religion. According to Bergson, the myth-making function is a virtual instinct in humans, and restrains intelligence from needless reflection. In fact, several studies on the myth-making function have focused on the relation between instinct and intelligence. On the other hand, Bergson also insists that the myth-making function is a form of imagination and, nonetheless, that there are also differences between that function and psychological imagination. Little attention has been given in secondary studies , however, to the myth-making function as imagination. Ribot's theory concerning imagination, ‘‘creative imagination’’ (imagination créatrice) offers the key to an understanding of the myth-making function. Ribot recognizes that primitive people think of natural phenomena analogically and emotionally and considers creative imagination to be an origin of religion, art, and science. Bergson deals with similar subject matter, but the myth-making function is different from creative imagination in that religion is the origin of the myth-making function. Furthermore, Bergson expects religion to be divided into science, art, and philosophy. Consequently, in Bergson, imagination is not important. What matters is religion; which rather than being caused by imagination, causes imagination.

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The concept of objectification in life philosophy and natural science

Marika Hirama

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Abstract:

In this paper, I will focus on two German philosophers, who dealt with problems of human life and attempted to establish a rigorous method equivalent to that of natural science. My aim here is to elucidate the differences and similarities in the meanings of the term *‘objectification’* as used in life philosophy and natural science.

During the time of his early studies, Martin Heidegger analyzed human life in a philosophical way. In that period, *Life philosophy* still held a strong influence in Continental philosophy. It generally attempted to approach human life in a different way to experimental psychology or biology. This movement of thought inspired the young Heidegger`s ideas. Wilhelm Dilthey, one of the leaders of *Life philosophy,* had a particularly profound influence on early Heidegger to express the life. The two philosophers take contrasting attitudes, however, toward the way of natural science.

Dilthey tried to express the inner structure of life objectively. His aim was to make a science of human life which stood comparison with natural science. Although he distinguished the domain of life (spirit) and that of nature, he relied on natural science with respect to the way of objectification.

In contrast, Heidegger radically rejected scientific objectification. He thought that life in its own structures could never be grasped by means of such way. Thus he had to search for another criterion of objectification. According to him, objectivity meant:— *'not being apart from the acting life'* —.

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Autonomous decision-making and informed consent

Haruka Hikasa

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¥Abstract:

In a time of technical progress, medical technology has made particular progress. Decision making is required in the use of technology. In years gone by, doctors would make the choices regarding the best medical treatment options for the patient. Now, generally the patients themselves make the choice of whether to undergo certain medical treatments, and may even refuse medical treatment at the cost of their life. This is based on a principle of "respect for autonomy"; the acceptance that a person should make decisions according to his/her own values and beliefs.

Such respect for autonomy is a principle which occupies a central position in bioethics. Moreover, in order to protect that principle, the informed consent of the patient for his/her medical treatment is thought to be indispensable. In other words, healthcare providers disclose relevant information to a patient, and a patient makes an autonomous decision having understood the situation.

However, the relation between autonomy and informed consent is not immediately clear, and various arguments exist concerning it. Therefore, I would like to consider the prerequisites of "respect for autonomy" in decision-making, and the way in which informed consent ought to be practiced. This problem is important to a considered understanding of human life in an age of science and technology.

Memo