

Topical Group on Few-Body
Systems
and Multiparticle Dynamics

Newsletter, March 2009



GFB turns 25!

Special contribution by **Frank S. Levin**, founder and first Chair of GFB:

GFB 25th Anniversary Newsletter

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● **MESSAGE FROM THE CHAIR**

Greetings to all members of the Few-Body Topical Group (GFB) and best wishes for the coming year.

This is the 25-th year of the few-body topical group. It was originally founded by Professor

Frank Levin of Brown University and for the past 25 years it has served as a forum for scientists working on few-body problems in different disciplines to share research contributions of common interest. Our governance, which includes officers from the atomic physics, chemical physics, and nuclear physics communities reflects the interdisciplinary nature of the GFB membership. Today the few-body topical group has members from all over the world.

During this period the effort invested by many physicists on the two and three-nucleon problem has transformed low-energy nuclear physics into a quantitative science: not only for two and three-nucleon systems, but for systems of as many 40 nucleons. Recent advances have made it possible to extend this quantitative understanding to even larger systems and much higher energy scales. Thanks to conceptual, computational and experimental advances, a frontier of nuclear science today is the prediction of the properties of light nuclei from interactions rooted in QCD. Effective field theory treatments of few-nucleon systems have provided new insight into the relation between the two and three-body interactions. The problem of treating reactions with three charged particles, which was a topic of discussion for many years in the few-body community, has now been solved. Meanwhile, breakthroughs are leading to extraordinary developments in the physics of dilute atomic systems. The Efimov effect, which is an exotic property of three-body systems with zero-energy two-body bound states, has now been observed experimentally due to impressive advances in experimental few-body physics. See Brett Esry, Doerte Blume and Ravi Rau's article in our 25-th anniversary newsletter for more discussion of some of these exciting topics. Several of these advances are a direct result of the synergy between different areas of few-body physics; one example is J-matrix methods, which were developed for problems in quantum chemistry and are now being used in precision nuclear structure calculations.

Today few-body physics is the topic of a number of regular international conferences, which include the international IUPAP conferences on few-body problems in physics, the Asia-Pacific conferences on few-body problems in physics, and the European conferences on few-body physics. In 2009, few-body physics will be featured at two upcoming INT programs as well as an ECT* workshop. The details are listed under [Other Meetings](#) in this newsletter.

We are proud that in these 25 years many of our members have been elevated to APS Fellows. This year we are pleased to congratulate *Daniel Phillips* and *Bela Sulik*, who are recognized as APS Fellows this year.

Membership Drive

GFB is active in promoting its current members and in increasing its membership. The group offers many benefits, some of which are described in this newsletter.

We ask all our members to identify potential new members and encourage them to join GFB. Please encourage in particular your graduate students, especially those who are already signing up for APS, to choose GFB as one of their units. (Students can sign up for two free units, which remain free even past the first year.) It is easy to add a Topical Group to your

membership:

visit <http://www.aps.org/membership/units/join-unit.cfm>. This page also contains information regarding Topical Groups for student members.

As part of this membership drive, GFB will be handing out forms for a one-year free membership during the APS April Meeting. If you know of anyone who is not attending the meeting but might be interested in this opportunity, please contact me for more information.

The GFB Nominating Committee (Bill Reinhardt, Doerte Blume, Bill McCurdy and Jim Vary) are hard at work preparing a list of candidates running for Vice-Chair and the Executive Committee. You will receive the ballots later this months and I urge you to cast your vote.

Wayne Polyzou Chair, GFB
Department of Physics
University of Iowa
[<polyzou@uiowa.edu>](mailto:polyzou@uiowa.edu)

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● **CALL FOR APS FELLOWSHIP NOMINATIONS**

A major benefit to the members of the topical group is that they can be nominated through GFB to become Fellows of the APS. The number of nominations depends crucially on our total membership. We had two new Fellows last year (see below).

Please consider nominating colleagues worthy of this distinction. Current APS members (and their affiliations) can be found on the [APS Membership website](#), while Fellows are listed on the [Fellowship website](#). Members from under-represented groups should not be forgotten. Note also that if we nominate distinguished members from foreign institutions we might be able to promote more members using leverage of co-sponsorship with the Forum for International Physics (FIP).

Information regarding the nomination procedure is available at the APS Fellowship website. The DEADLINE for nominations through GFB is April 1st. Please make sure that the full package has been submitted to the APS website before this date.

Information regarding the nomination procedure and the necessary forms can be easily obtained through the APS Fellowship website. (www.aps.org/programs/honors/). The **deadline** for nominations for our Topical Group is this year April 1. Please make sure the full package has been submitted to the APS before this date.

This year's Fellowship Committee consists of Ricardo Alarcon, Brett Esry, and Bira van Kolck (chair). If you have any questions, please feel free to contact [Bira van Kolck](#)

CONGRATULATIONS TO OUR NEW FELLOWS

Congratulations to Daniel Phillips, and Bela Sulik, who were elected to Fellowship in the APS under the auspices of the GFB last year.

Daniel Phillips' fellowship citation reads

For his research on effective hadronic theories of few-nucleon systems, especially on the role of the Delta(1232) and the description of electromagnetic reactions on light nuclei, and their application in obtaining reliable information on neutron properties from experimental data.

Bela Sulik was cited

For numerous significant contributions, both theoretical and experimental, to the fundamental understanding of atomic and molecular collisions, and especially for his work on multi-electron and multiple scattering processes with ionic projectiles.

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● APRIL MEETING

Every year GFB sponsors sessions at APS meetings, which highlight work by, and of particular interest to, its members. GFB will have two sessions at the 2009 [APS April meeting](#), which will be held in Denver, May 2-5. These sessions are co-sponsored with the Division of Nuclear Physics (DNP) and organized by A.R.P. Rau and Z.-E. Meziani:

- *May 2, 13:30 - 15:18 Few-Body Physics I*, Chair: A.R.P. Rau (Louisiana State University):
 - D. Blume (Washington State University), "Few-body aspects of dilute Fermi systems"
 - I. Mazumdar (Tata Institute), "Three-body approach to light two-neutron halo nuclei"
 - M. Ahmed (Duke University), "Few-body studies at TUNL/HIGS"
- *May 3, 08:30 - 10:18 Few-Body Physics II*, Chair: R. Gilman (Rutgers University):
 - G.G. Petrakos (Kent State University), "JLab few-body form factor measurements"
 - S. Kuhn (Old Dominion University), "From deuterium to free neutrons -- recent experimental results"
 - J. Shepard (University of Colorado), "Finite-range effects in atomic and nuclear three-body physics"

Please also plan to attend the GFB business meeting, which will be held on Sunday, May 3, 12:30 following session J13 - Few-Body Physics III in room Plaza Court 3.

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● OTHER MEETINGS

The 19th International IUPAP Conference on Few-Body Problems in Physics will take place in Bonn, Germany, August 31 - September 5, 2009

FB19 is intended to bring together scientists interested in few-body aspects of physics, emphasizing recent developments in nuclear, particle, atomic, and molecular physics. Further

information can be obtained at the official website for [FB19](#).

In 2009, few-body physics will be featured at two upcoming INT programs

- [`Effective Field Theories and the Many-Body Problem`](#) (March 23 - June 5, organized by Calvin Johnson, Richard Furnstahl, Erich Ormand, and Ubirajara van Kolck)
- [`The Jefferson Laboratory Upgrade to 12 GeV`](#) (September 14 - November 20, organized by Gerald Miller, Rolf Ent, Carlos Munoz Camacho, and Tony Thomas),

as well as an ECT* workshop

- [`Relativistic Description of Two- and Three-body Systems in Nuclear Physics`](#) (October 19 - 23, organized by G. Salme, T. Frederico, and M. Viviani).

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● GORDON CONFERENCES

There is not currently a Gordon Conference on Few Body Problems. However, there are Gordon Conferences on Atomic Physics, Nuclear Physics, and Nuclear Chemistry that may be of interest to some of our membership.

- The Gordon Conference on [Atomic Physics](#) will take place June 28 - July 3, 2009 at the Tilton School, in Tilton, NH.
- The Gordon Conference on [Nuclear Chemistry](#) will be held June 21-26, 2009, at the Colby-Sawyer College in New London, NH.
- The Gordon Conference on [Nuclear Physics](#) will take place July 12-17, 2009, at Bryant University in Smithfield, RI.

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● CANDIDATES BIOGRAPHIES AND STATEMENTS

● CANDIDATES FOR VICE-CHAIR

Hossein Sadeghpour

ITAMP, Harvard-Smithsonian Center for Astrophysics

Biography

B.S. Mech. Engr. LSU 1981, M.S. Mech. Engr. LSU 1983, Ph.D. Physics LSU (thesis research at JILA) 1990. DOE Postdoc, Harvard 1990-1994. Staff member at Institute for Theoretical Atomic Molecular and Optical Physics (ITAMP) - Harvard-Smithsonian Center for Astrophysics 1994-present. Physicist, Harvard-Smithsonian Center for Astrophysics, 1994-present. DAMOP Outstanding Ph.D. Thesis finalist, 1993. Fellow, American physical

Society, 2005. Committee member and chair, DAMOP/APS Prize Committee on Most Outstanding Thesis, 1998-1999. ICAP2002 Program Committee and Proceedings Editor. Organizer of several other conferences in the US, Japan, and Germany.

My interests in research are: in control of cold and ultracold collisions of few bodies (atoms and molecules), leading to spin relaxation and quenching, and collisional recombination; in recombination of a few charged particles (Rydberg atom formation) in sea of many-body ultracold neutral plasma or highly-magnetized cold non-neutral antimatter plasma; in cooling and trapping of magnetized Rydberg atoms and molecules; in photo-detachment processes for catalysis of the early Universe molecule formation; in atomic recombination which determine the neutralization of the early Universe (epoch of recombination); in interaction of atoms (cluster formation), molecules (encapsulation), and electrons (confined quantized motion) with nano systems, such as graphitic sheets and nanotubes/nanowires. Some of the above topics require first-principles few-electron structure calculations of potential energy surfaces, transition matrix elements, mean-field treatment, and coupled-channel scattering calculations.

Candidate's Statement

Few-body physics is a well-established discipline in atomic, molecular, and nuclear physics, which now finds applications in modeling of soft condensed-matter strongly-correlated systems. It may now be possible to, for instance, formulate a basic understanding of the cross-over from the superfluidity to superconductivity (BEC-BCS) using a few atoms (as few as four fermionic atoms)- two fermions pair up to create a boson. Emulating the intractable correlated electron interactions in solids, using atoms in an optical lattice, is a growth industry, from which few-body physics would benefit, as well as contribute in a significant fashion. Much of this emulation is done by tweaking two-body, three-body and four-body interactions. This order of business is indeed inter-disciplinary.

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Turgay Uzer

School of Physics, Georgia Tech

Biography

Turgay Uzer works in the School of Physics at the Georgia Institute of Technology, where he holds the rank of Regents Professor. He is also a member of Georgia Tech's Center for Nonlinear Science.

He did postdoctoral research at Caltech and University of Colorado in Boulder after receiving a doctorate from Harvard University. His research interests are semiclassicals, electron dynamics in the Correspondence Principle limit, the dynamics of classically chaotic systems (especially Rydberg atoms and molecules), energy flow in atoms and molecules, Transition State Theory, and high-field phenomena.

He was elected fellow of the APS in 1999 and is the recipient of a Humboldt Research Prize.

He co-organized an ITAMP workshop on Strong Perturbations of Atomic and Molecular Rydberg States, a NATO ASI on the Frontiers of Chemical Dynamics and an ITAMP Topical Group on Theoretical Challenges in Attosecond Laser Science.

Candidate's Statement

The highly interdisciplinary nature of my research has always forced me to remain aware of developments in disciplines bordering on physics, which can be as diverse as chemistry, nonlinear dynamics and astronomy. I see the Few-Body Systems Group as a unique collection of like-minded researchers who share my wide interests. I have learned first-hand how much one benefit from interacting with practitioners from other fields, and I would like contribute to greater interactions among the members of the GFB through the organization of cross-disciplinary meetings which will foster such intellectual exchanges.

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● **CANDIDATES FOR EXECUTIVE COMMITTEE**

Michael Bromley

San Diego State University

Biography

Michael Bromley is currently an Assistant Professor of Physics at San Diego State University. His research interests lie amongst computational atomic, molecular and optical physics. In particular, the bound and scattering states of three and four body systems composed of a positron and a multi-electron atom. His calculations extend out to neutral atom-atom dispersion interactions and long-range molecules. His group also researches many-body systems of Bose-Einstein condensates with applications to atom interferometry and their interactions with laser fields.

Michael obtained a B.Sc. from the Northern Territory University in 1995 and a B.Sc.(Honours) from The University of Melbourne in 1997 (supervisor: Ann Roberts). He obtained his Ph.D. back at NTU in 2003 (supervisor: Jim Mitroy), and was awarded the 2003 Australian Institute of Physics Bragg Gold Medal for Excellence in Physics. He was a Research Associate at Kansas State University between 2002-2004 (supervisor: Brett Esry), and a Research Fellow at the Charles Darwin University in 2004-2005 (supervisor: Jim Mitroy). He was awarded the first Sheldon Datz Prize from ICPEAC in 2005, before joining the physics faculty at SDSU in 2005. He has formed an international partnership with the (Australian-based) Centre for Antimatter-Matter Studies.

Candidate's Statement

The APS's GFB has a strong role to play in binding together the disparate fields of few-body physics. Whilst the state-of-the-art in one sub-field is often a decade behind what is possible in others for purely technical reasons, the insights gained in each are immediately

transferable. Whilst my interest and expertise is in atomic physics, I try to keep an eye on the latest developments and computational methods that are evolving throughout condensed matter, chemical and nuclear physics. As an executive member I would strive to further build this topical group to involve researchers from all of the experimental and theoretical few-body walks-of-life.

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Mette Gaarde

Louisiana University

Biography

Mette Gaarde is an Associate Professor of Physics at Louisiana State University. She received her PhD in 1997 from Copenhagen University in Denmark, and worked as a postdoctoral researcher at the University of Lund in Sweden (1998) and at Louisiana State University (2000). She was a Research Assistant Professor at the University of Lund between 1999 and 2003, when she joined the Faculty at Louisiana State University.

In 2008 she was Vice-Chair, and in 2010 will be Chair of the Gordon Research Conference on Multiphoton Processes. She is interested in the interaction between small quantum systems (atoms and molecules) and strong laser fields, in particular in the generation and application of attosecond pulses of extreme ultraviolet light.

Candidate's Statement

My research program is centered around theoretically studying the interaction between an intense ultra short laser pulse and a macroscopic number of atoms in a gas. I am particularly interested in the interplay between the few-body physics that takes place at the level of an individual atom interacting with the strong laser field, and the macroscopic effects arising from the propagation and phase matching of the laser and XUV light in the gas medium. My research lies at the interface between atomic physics, non-linear optics and laser physics, and I have benefitted enormously from close collaborations with both experimentalists and other theorists across all of these fields.

I believe the Topical Group on Few-Body Systems and Multiparticle Dynamics is an ideal forum for interdisciplinary exchange of ideas between AMO and chemical and nuclear physics. As an executive committee member I would strive to promote opportunities for interdisciplinary exchanges through conferences, workshops and increased membership.

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Viatcheslav Kokoouline

University of Central Florida

Biography

iatcheslav Kokoouline earned his Ph. D in Physics from the University of Paris XI, Orsay, France in 1999 in a framework of a joint French-Russian Ph.D program. His research of theoretical methods for ultra-cold molecules was jointly supervised by Françoise Masnou-Seeuws from University of Paris XI and Valentin Ostrovsky from the Institute of Physics, University of St-Petersburg, Russia. During his postdoctoral stay (1999-2000) in the Fritz Haber Center for Molecular Dynamics at the Hebrew University of Jerusalem, he was continuing studying the ultra-cold molecules in the theoretical group of Ronnie Kosloff. During his stay (2000-2003) at JILA as a postdoctoral associate in Chris Greene's group, he studied the breakup of the H_3^+ ion in collisions with slow electrons (dissociative recombination of H_3^+), which a quantum four body problem (3 protons and the incident electron). He also studied ultra-cold binary atomic collisions in a presence of an external field.

He has been an Assistant Professor in Physics at the University of Central Florida since 2003, and will be an Associate Professor starting in August 2009.

Candidate's Statement

My research interests lie at the interface of chemical physics, atomic and molecular physics. In particular, I'm interested in development of theoretical and accurate computational methods for few-body processes in ultra-cold gases (including processes in Bose-Einstein condensates and degenerate Fermi gases), simple chemical reactions at thermal energies, dissociative recombination of small polyatomic ions. My theoretical research activity has always been closely linked to the existing experiments. I collaborate with a number of experimentalists in different labs. I'm also interested to apply the developed methods and fundamental principles from theoretical atomic/molecular physics to problems having a practical interest.

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