Topical Group on Few-Body Systems and Multiparticle Dynamics

Newsletter, March 2011

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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.

Few-body physics continues to thrive. Cold-atom experiments produce new, exciting results in nearly every issue of PRL. The universality of the physics of large scattering lengths provides fertile common ground for theorists in the different subfields comprising our group. The development of ever larger computational techniques allows the effects of few-body interactions on multi-particle dynamics to be studied with unprecedent confidence. GFB has strived to capitalize on this propitious moment.

The last year has seen the retirement from GFB of Wayne Polyzou. I take this opportunity to thank him for the four years of service. Anybody who knows Wayne will not be surprised to hear that his dedication and generosity played an essential role not only in keeping GFB

activities going but also in educating junior officers.

For the hefty task of filling Wayne's shoes, we welcome our new elected officer, Calvin Howell from Duke University. Calvin is an accomplished experimental nuclear physicist who heads TUNL, the lab at Duke that has made major advances in the study of few-nucleon systems and provided leadership to GFB in the past (for example, Werner Tornow not long ago).

Ravi Rau is now Past-Chair, and in this capacity has very efficiently led the Nominating Committee in providing us with a slate of capable candidates for new officers. Every year we elect one member for the Chair line and two members for the Executive Committee. This year's Nomination Committee consisted of Mike Cavagnero, Daniel Phillips, James Shaffer, Janine Shertzer, and Ravi Rau (chair). They chose an excellent set of candidates: Doerte Blume (Washington State) and John Delos (William & Mary) for Vice-Chair, and Robert Forrey (Penn State), Dean Lee (NC State), Wolfgang Korsch (Kentucky), and Charles Weatherford (Florida A&M) for the Executive Committee. Their bios and statements can be found below.

Soon ballots will go out and I urge everyone to vote. As always, please keep in mind our traditional balance among subfields. The continuing Executive Committee members (with expiration dates) are Mette Gaarde (2012), Michael Bromley (2012), Werner Boeglin (2013), and Pieter Maris (2013). We thank Dick Furnstahl and Sandra Ward-Quintanilla, who are rotating out, for their service.

An important component of GFB activities is the organization of invited and contributed sessions at APS meetings. As usual, the hard work of organization falls on the Chair-Elect, Hossein Sadeghpour. Besides the traditional sessions at the April Meeting, Hossein has been working to increase the presence of few-body physics at the DAMOP meeting, where this year there is an invited session on three- and four-body Efimov states. Hossein describes the planned April Meeting sessions below.

In addition, few-body physics is the topic of a number of international conferences, which include the Asia-Pacific Conferences on few-body problems in physics, LEAP and POSMOL 2011. Meetings of possible interest to the few-body community are listed on the GFB website under Meetings of Interest.

Every year we also have the opportunity to put before the APS candidates for fellowship. We had two fellows elected in 2010, Hans Hammer of Bonn University and Alejandro Kievsky of the INFN-Pisa, as you can read in Hossein's report below. This year's deadline for nominations is April 1st. Please nominate deserving candidates!

Please also, as always, encourage your colleagues, postdocs and students to join GFB. We can continue our activities only as long as we are above a minimum size required by the APS. It is an exciting time to be a member. 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.

Yet, as we make so much progress in our field, this past year we mourned the loss of some members. Many of us were particularly touched by the loss of John Tjon from the University of Utrecht. We have gathered below some recollections of John's life.

As Chair, I quickly learned that nothing of this would come to anything were it not for the person who does all the work behind the scenes, our secretary/treasurer Charlotte Elster. She is the institutional memory that will ensure there is a new newsletter next year!

Bira van Kolck Chair, GFB
Department of Physics
University of Arizona
<vankolck@physics.arizona.edu>

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CALL FOR APS FELLOWSHIP NOMINATIONS

(Hossein Sadeghpour and Bira van Kolck)

CONGRATULATIONS TO OUR NEW FELLOWS

GFB has two newly-minted APS fellows. Please join us in congratulating this jolly bunch. They are:

Congratulations to **Hans-Werner Hammer** (Rheinische Friedrich-Wilhelms Universität Bonn), whose citation reads

"For significant advances in the few-body problem in both nuclear and atomic physics, particularly through the use of effective field theories, and for elucidating the universal properties of Efimov states and related phenomena in three- and four-body systems."

and **Alejandro Kievsky** (INFN Pisa), whose citation reads

"For contributions to the development of the hyperspherical-harmonics method for few-nucleon systems, and particularly for precise studies of the continuum in three-nucleon systems."

There is still time to nominate fellows for this year's election. The DEADLINE to nominate through GFB is April 1st. The 2011 Fellowship Committee will be headed by Calvin Howell. Please think of members who deserve this award. Current APS members (and their affiliations) can be found on the APS Membership website , while Fellows are listed on the Fellowship website.

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.

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APRIL MEETING

(Hossein Sadeghpour)

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 2011 APS April meeting , which will be held in Anaheim, April 30 - May 3.

- *Session C4*, Saturday, April 30 at 10:45 am:
  Proton Charge Radius and Precision QED
  This session will have three invited speakers, Randolph Pohl (MPQ), Jan Bernauer (MIT), and Savely Karshenboim (MPQ). The recent new experiment on the Lamb shift in muonic atoms will be presented. Note that there will also be a plenary talk by William Marciano (Brookhaven) on "What's Up with the Proton Radius?" in Session V1: Plenary Session III.
- *Session Q6*, Monday, May 2 at 10:45 am:
  Spectroscopy and Interactions inf Four and More-Body Systems Three invited speakers --Randall Hulet (Rice), Jose P. D'Incao (JILA), and Lucas Platter (INT) will cover the recent developments in experiment and theory on Efimov three- and four-body spectra. This session is organized jointly by DAMOP.

We hope you can attend!

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John Tjon Remembered

(Charlotte Elster, Wayne Polyzou, and Bira van Kolck)

In September 2010 John A. Tjon, one of the "giants" in the field of Few-Body Physics passed away. He made many ground breaking contributions in different aspects of the field, and his breadth of work remains a role model for us at GFB.

We were saddened by his unexpected passing and can here only provide a glimpse at this remarkable researcher and person. John's work was influential with many researchers, collaborators, postdocs and students. We consider it most appropriate to let members of the few-body community speak in his memory, and collected those voices here.

In the December issue of Physics Today, Ben L.G. Bakker, editor of Few-Body Systems, Franz Gross, Rudi Malfliet, and Steve Wallace published an obituary, which we want to refer to Physics Today, December 2010.

A while earlier, his former student, Rudi Malfliet, now Emeritus Professor at the University of Groningen, wrote a laudation in Few-Body System, Volume **28**, 1998, which was

dedicated to John Tjon on occasion of his 60th birthday. We thank SpringerLink and Ben Bakker for allowing our members access to this article at www.springerlink.com/content/0177-7963/24/2-3/.

In October 2009, the ECT* in Trento, Italy, hosted a workshop on *Relativistic Description of Two- and Three-Body Systems in Nuclear Physics*. The proceedings of this workshop are published as special issue of Few-Body System, Volume **49**, 2011. During the review and editorial process of this volume, the news of John's passing reached the community. The workshop organizers, Tobias Frederico, Giovanni Salme, and Michele Viviani, decided to dedicate this special issue of Few-Body Systems to the memory of John Tjon. We again thank SpringerLink and Ben Bakker for allowing our members access to this article at www.springerlink.com/content/0177-7963/49/1-4/.

John Tjon had many students and collaborators who were strongly influenced by his work and ideas. We close this section of the newletter with short recollection of memories of John Tjon by one of his early students from Utrecht, Willem Kloet, Professor at Rutgers University.

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CANDIDATES BIOGRAPHIES AND STATEMENTS

CANDIDATES FOR VICE-CHAIR

Doerte Blume
Washington State University

Biography

Doerte Blume earned her Ph.D. in Physics from the Georg-August University in Goettingen, Germany, in 1998. Her theoretical research on doped superfluid helium clusters was jointly supervised by Birgitta Whaley from the Chemistry Department, Berkeley, and Peter Toennies from the Max-Planck Institute for Fluid Dynamics, Goettingen, and was supported by Max-Planck and DAAD graduate fellowships. During her stay at JILA as a postdoctoral associate in Chris Greene's group, she explored the behaviors of van der Waals clusters and Bose-Einstein condensates. Part of her postdoctoral work was supported through a DFG postdoctoral fellowship. She joined the physics faculty at Washington State University in 2001. She was a JILA Visiting Fellow in 2007, served on the DAMOP Program Committee and the GFB Executive and Nominating Committees, and is currently serving on the Editorial Boards of Physical Review A and Journal of Physics B. She is a Fellow of the APS.

Her research interests fall into the areas of cold atom physics and few-body physics. In particular, she studies atomic Bose and Fermi gases under varying confinement, scattering in low-dimensional systems, Bose liquids such as atomic helium and molecular para-hydrogen clusters, and universal features of strongly-interacting Bose and Fermi liquids and gases.

These studies have close ties to atomic, molecular, chemical, nuclear and condensed matter physics.

Candidate's Statement

My theoretical research focuses on an in-depth understanding of dilute and strongly-interacting inhomogeneous Bose and Fermi systems. Starting from well-characterized two-body potentials, my goal is to develop and apply analytical and numerical treatments that describe these systems accurately in terms of a few key quantities. In particular, understanding the bound state and scattering properties of "simple" few-body systems lies at the heart of my research efforts. In this endeavor, I much enjoy the interdisciplinary possibilities. Many of the techniques that I apply were pioneered in nuclear physics, and have later found applications in chemical, atomic and molecular physics. The few-body community provides a bridge between these different sub-disciplines of physics, and my efforts are aimed at providing platforms, through extended workshops and conferences, that facilitate cross-disciplinary exchange of ideas. As a Chair of the Topical Few-Body Group, I would work to ensure representation of few-body physics at meetings such as the March and April meetings and DAMOP. I would also work to increase the visibility and the membership of the group.

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John B. Delos
College of William and Mary

Biography

John Delos is Professor of Physics at William and Mary, where he joined the faculty in 1971. He is author of somewhere around 120 papers, mostly published in Physical Review or Journal of Chemical Physics. His research has been at the boundary of classical and quantum physics, studying atomic collisions, high Rydberg states of atoms, and excited states of molecules, using methods of nonlinear dynamics and chaos theory. He has held research grants from National Science Foundation continuously for about 30 years, and he received grants from Office of Naval Research for about ten years. He is fellow of the American Physical Society, Outstanding Scientist of Virginia (1990), and a few years ago was elected as Chair of the Division of Atomic, Molecular and Optical Physics of APS (2600 members). Now he has a new project applying nonlinear dynamics to the study of heart rates and respiration of infants in neonatal intensive care units. For seven years he taught a Freshman Seminar titled "Ethical Issues in Men's Lives"; readings and discussions included Aristotle's Ethics, moral development of children, family structures, and biological perspectives on human ethics.

Candidate's Statement

Physics began with the study of few-body systems, and this field is still exciting. Few-body science is intrinsically interdisciplinary, having workers studying problems in chemistry,

atomic physics, celestial dynamics, mesoscopic transport, nuclear and particle physics, and mathematics. We have direct connections also with fluid dynamics, through the study of chaotic transport. The goal of the Few-body Topical Group must be to find the common themes that cut across the sub-disciplines of physics, and to organize symposia around those common themes. No one person has the breadth and depth of knowledge to cover all the areas of interest, so we must work together toward this common goal. My particular knowledge is in the areas of nonlinear dynamics and chaos theory applied to classical and quantum systems. This field has a long tradition of interdisciplinary conferences, bringing together scientists in all the areas mentioned above. I would continue this tradition with the Few-Body Topical Group.

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CANDIDATES FOR EXECUTIVE COMMITTEE

Robert Forrey
Penn State University

Biography

Robert Forrey received his PhD in Physics in 1995 from the University of Delaware. His theoretical research on two-electron atomic systems was jointly supervised by Robert Nyden Hill and John Morgan. During his graduate work, he received pre-doctoral research fellowships at ITAMP and the Smithsonian Astrophysical Observatory. After completing his PhD, he worked as a post-doctoral research associate at Harvard University with Alex Dalgarno. He started as Assistant Professor at Penn State University at Berks in 1999, became Associate Professor in 2003, and Professor of Physics in 2006. He has participated in many topical workshops, co-organized an ITAMP workshop on ultra-cold molecules, and was a member of the local organizing committee for the 2008 APS DAMOP meeting.

His current research interests include ultra-cold atomic and molecular collisions, collision induced dissociation of molecules, and hydrogen chemistry on metallic clusters. He has also done theoretical research on electron-electron correlation, double photoionization, and matter wave optics. He has published more than 70 refereed journal articles, including 10 with undergraduate student co-authors.

Candidate's Statement

Much of my research activity is interdisciplinary and I have benefited greatly by working with colleagues whose experience in certain areas is far greater than my own. I view service activities in the same way and would look for opportunities to develop and encourage collaborative interactions between researchers in diverse areas of physics, chemistry, and astrophysics who are interested in few-body systems and multi-particle dynamics.

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Wolfgang Korsch

University of Kentucky

Biography

Wolfgang Korsch is a professor of physics at the University of Kentucky. He received his diploma in experimental physics and his Ph.D. from the University of Marburg (Germany). The research studies for his degrees were conducted at the Max-Planck Institute for Nuclear Physics (Heidelberg). In 1991 he accepted a postdoc position at MIT and in 1993 he became a research fellow at Caltech. An appointment as a faculty member at the University of Kentucky followed in 1996. His main research interests range from atomic to low and medium-energy nuclear physics.

Candidate's Statement

Throughout my whole scientific career I have been fascinated by fundamental interactions and symmetries in Nature. Understanding the quark-gluon structure of nucleons as well as tests of parity and time-reversal violation in "simple" systems have been my main interests. Since most fundamental interactions preserve these symmetries to an incredibly high accuracy, the search for violations becomes more and more demanding and imposes severe challenges on experimentalists and theorists. Many of the problems to be tackled are truly multi-disciplinary and require techniques commonly used in atomic, nuclear, and particle physics. In my opinion, this is the main reason why a topical group of few-body systems is of crucial importance. A group where people with expertise in different subfields can meet and exchange knowledge. I have been a member of several small- and medium-size collaborations and I have occupied leadership roles (scientific and administrative) in some of these experiments. Given that background, I believe that I can judge the importance of the cross-disciplinary nature of high precision experiments. If elected, I will strongly further the synergy of the different subfields and encourage experimental as well as theoretical efforts to enhance and improve our understanding of few-body systems.

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Dean Lee

North Carolina State University

Biography

Dean Lee received his Ph.D. in theoretical physics from Harvard University in 1998. He then became a postdoctoral researcher at the University of Massachusetts Amherst before joining the physics faculty at North Carolina State University in 2001. His research involves new analytical and numerical approaches to few-body and many-body systems in nuclear physics and cold atomic systems. He and collaborators have pioneered many of the strategies and techniques used in the emerging field of lattice effective field theory. Applications of lattice effective field theory span a wide range of few-body systems including cold fermionic atoms at large scattering length, two-dimensional Bose droplets, Wannier excitons in quantum dots,

and the low-energy spectrum of the carbon-12 nucleus.

Candidate's Statement

There are many things beautiful about few-body systems. Physicists from diverse backgrounds work on a myriad of different problems but also discover unifying themes and universal characteristics. Analytical, experimental, and numerical researchers push the frontiers of precision science in the 21st century. The few-body community has a good story to tell. As a member of the Few-Body Topical Group Executive Committee, I would like to help widen the field and to elevate its visibility. I am interested in expanding the traditional boundaries of the field into new areas. I would also like to explore how landmark results and unsolved puzzles in our field can be given more visibility to the general public.

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Charles A. Weatherford

Florida A&M University

Biography

Dr. Charles A. Weatherford is a Professor of Physics at Florida A&M University (FAMU) in Tallahassee, Florida. Dr. Weatherford received his Ph.D. from Louisiana State University in 1974. He then had postdoctoral fellowships at FAMU and NASA Goddard Space Flight Center. He worked summers at IBM Almaden, NASA Ames, and the Department of Energy Laboratories at Argonne and Lawrence Livermore. He has served as a faculty member in the Physics Department at FAMU since 1982. He has been Physics Chairman at FAMU for sixteen of the last twenty-one years. During this time he helped start a Masterâ€™s (1998) and a Doctoral (2001) degree program in Physics.

Dr. Weatherford has one hundred and eighty two publications, sixty-five of which were peer reviewed. His work is almost exclusively computational and involves various small to medium size atomic and molecular systems, in isolation and in collision. A computational theme has been the use of high performance computers and modern partial differential equation techniques such as finite, spectral and pseudo-spectral elements. In particular, he has studied atom+ion charge exchange, electron+molecule collisions, and laser+molecule interactions using the techniques of quantum control to shape laser pulses. He has recently studied small to medium size clusters composed of various combinations of iron, carbon, and oxygen atoms. A number of publications have involved the construction of efficient computer codes to calculate multicenter integrals over exponential-type orbitals and the study of electron correlation. A recent focus has been the application of an original algorithm for initial-value problems, which uses spectral elements in time.

Candidate's Statement

Few-body systems (FBSs) are important from a number of different perspectives. Even the hydrogen atom and the hydrogen negative ion (H-) are important for understanding the

atmospheres of stars. Yet, systems as simple as H-, even today are a computational challenge, particularly when the calculation concerns the auto-detaching states and their lifetimes. Quantum control is a new field, which attempts to manipulate atoms, molecules, and even condensed matter systems with lasers. The techniques of quantum control are today being applied to FBSs, while the manipulation of larger systems is just beginning. Low-temperature systems, alternative-dimensional confined systems, quantum computing, and information theory provide new and exciting venues for the study of FBSs. While it is not absolutely necessary to test methods, intended for large systems, on FBSs, it is frequently quite useful and often critical for success. The use of high-performance computers and modern computational methods is infiltrating the undergraduate physics curriculum and high-quality calculations on FBSs are the ideal application test-bed for these undergraduate courses. The study of FBSs, using modern software and hardware, in the undergraduate and graduate physics curriculum and the promotion thereof, is the primary theme of my candidacy for the executive committee. Thus, few-body physics is a vibrant and thoroughly modern field, which is becoming richer and deeper with every passing month.

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