

Andrei V. Belitsky: Personal Statement

Research: My research related activities at ASU are multifold. They consist of three major ingredients: research per se in the form of individual and joint projects and grant solicitation; uprising a new generation of qualified physicists in my field of expertise by mentoring and supporting students and postdocs; continuing efforts to build a world-class Particle Physics and Astrophysics Group at ASU. All of these aspects are summarized below.

My major contribution to the field of hadronic and nuclear physics is in development of a novel approach to understanding quark confinement through the study of microscopic partonic characteristics of strongly interacting particle based on the concept of generalized parton distributions. This work laid the ground in the establishment and development of a number of concepts and directions in the field. These results were pivotal to warrant the current state of the art of the field and brought the whole subject to the level when it grew into the main experimental project driving the science of the 12 GeV energy upgrade of the Continuous Electron Beam Accelerator Facility in Jefferson Laboratory, Virginia. This major national project was recently funded by the Office of Nuclear Science of the U.S. Department of Energy. I have also made contributions in a wide range of other topics in hadronic physics and field theory. Particularly noteworthy among these is the discovery of perturbative integrability of four-dimensional Yang-Mills theories which, in light of the gauge/string duality, became a powerful novel approach to unraveling dynamics of gauge theories at strong coupling and presumably quantization of string theories on warped target spacetimes. I continue to pursue research in these fruitful directions with results being published in major physical journals like Nuclear Physics B, Physical Review Letters, etc.

The Theoretical Particle Physics and Astrophysics Group at the Department of Physics of ASU currently consists of three members, Richard Lebed, myself and Cecilia Lunardini. Cecilia was hired on a bridge position between ASU and Brookhaven National Lab. The latter provide financial support of academic positions in the amount of up to $\frac{3}{4}$ of annual salary, travel and other benefits for a period for up to six years. The realization of this position was a result of more than a year of negotiations. After getting a preliminary agreement from Prof. Barry Ritchie,--- former chairman of the Department of Physics and Astronomy,--- I have initiated talks with Dr. Larry McLerran (RIKEN Research Center Leader) from Brookhaven National. After successful negotiations with RIKEN Brookhaven Research Center and its director Dr. Nicholas Samios and approval by the Department of Physics new chairman Prof. Robert Nemanich, the group was granted a joint position with the Center. The addition of the RBRC-ASU collaborative position brought an important new facet to the program. With a new person on board, we will be able to develop more complex and multifaceted programs to involve and inspire graduate students and postdoctoral researchers.

After I was hired by the Department in 2004, I have immediately applied with my colleague, Richard Lebed, for a joint group Nuclear Theory grant from National Science Foundation. It was approved --- in a year of brutal Federal slashing of discretionary spending --- and the funding started in August 2005. My share is over \$70K/year. The total award from NSF is \$426,000 for three years which allowed us to successfully recruit and hire an outstanding postdoctoral research associate Dr. Dieter Mueller, now at Universitaet Bochum, Germany and then Dr. Herry

Kwee, who is going to Florida State University as a research associate. The available start-up funds which I had at my disposal allowed me to host two four-month visitors, Dr. David Karakhanyan of Yerevan Physics Institute, Armenia, and Dr. Sergei Derkachov of St.-Petersburg's branch of the Steklov Mathematical Institute, Russia. We had a fruitful scientific collaboration which spawned a number of joint publications. While my start-up funds were available, I ran for a year a biweekly seminar in Subatomic Physics with invited speakers from U.S. and Europe. I anticipated another member, Dr. Marc Kirch with fresh Ph.D. from Universitaet Bochum, to join our group last year. However this opportunity did not realize. Dr. Kirch was the second on the short list for our postdoctoral position last year which was given to Dr. Kwee. Marc had a very strong overlap with my research program. Since he was not offered the job, but still was very passionate to come and join our group, I agreed to serve as his host and pay a quarter of his salary for a year with the rest coming from some external funds. In May of 2006, Dr. Kirch and I have applied for a grant from the Fyodor Lynnen Program of the Alexander von Humboldt Foundation and in December of that year we were informed that it was granted in the amount of \$38,434/year. However, over the period of application pending support Dr. Kirch was estimating prospects and weighing job opportunities in academia and has made a very hard decision to pursue a career in industry. This was very unfortunate by a number of reasons with the major one being that Physics has lost an outstanding scholar. I am happy to say though that Marc had received a number of offers and has started his new job in the mid January of 2007 in a firm which designs optical systems for lithographic equipment.

Last year (2007), Richard Lebed and myself applied for the renewal of our grant from National Science Foundation. NSF FY08 appropriation was not at the level requested by the administration. Because of division priorities and prior commitments, most programs budgets this year were approximately 5% below last year. Because programs also had commitments to three-year awards made in prior years, the 5% effect was amplified by roughly a factor of 3, or 15%. Between theory and experiment, there was about \$1M less money available this year to apply to new and renewal proposals. Most of the best-rated investigators or groups received flat or reduced funding. However, our renewed grant got bumped up in 2008 to \$160,000 a year for three years totaling the award to \$480,000.

With successful recruitment of graduate students by the Department of Physics in 2006 and 2007, I am currently supervising three, Mr. Xiang Chen, Mr. Duncan McFarland and Mr. Joel Lynne, who have earlier declared interest in subatomic theory. Mr. Chen is working on the project of the physics beyond the Standard Model within the Lee-Wick framework which resolves the so-called little hierarchy problem. Mr. McFarland conducts research on the structure of hadrons within the framework of generalized parton distributions. Over the past half a year I was also supervising a student, Mr. Roman Pasechnik, from Universite de Paris XI together with Prof. Gregory Korchemsky of Laboratoire de Physique Theorique, Orsay. Roman will be joining our graduate program in the Fall 2008 semester. Mr. Pasechnik is developing a framework for calculation of critical exponents based on integrability of maximally supersymmetric gauge theory. This approach has profound applications to the proof of gauge/string duality and potential to the solution of the quark confinement in Quantum Chromodynamics. Currently, we have a paper in preparation with Pasechnik.

All these demonstrate that although the group is able to sustain healthy research and educational activity, it desperately needs a critical mass to strengthen its identity, to open novel directions of research that are not currently represented, and to obtain a higher level of joint grant support from funding agencies, which tend to support group grants at a higher per capita level when compared to a single researcher award.

In the past year, the Department of Physics has completed an extensive strategic planning initiative and has identified theoretical particle and nuclear physics and astrophysics as one of the areas of emphasis for the development significant expertise. This focus is strengthened with the formation of the School of Earth and Space Exploration (SESE). The School included the astronomy and astrophysics faculty from physics. It is now anticipated that the Department of Physics and the SESE will collaborate on the development of the theoretical particle astrophysics program. The recent move of Prof. Paul Davies to ASU is aligned with these possibilities. My research being interdisciplinary in nature,--- it lies on the interface of quantum field theory, string theory and integrable models of condensed matter physics,--- make me enthusiastic about the future prospects of building bridges between the Department of Physics and other research units at ASU. We view these opportunities with the newly launched institute directed by Prof. Paul Davies and Department of Mathematics, taking advantage of multifaceted aspects of string theory which range from landscape of vacua and anthropic principle in cosmology to algebraic geometry and topology in mathematics. My current and future efforts include continued advocacy for hires in these areas, as well as maintaining strong ties to SESE, with whom some interdisciplinary hires in these areas of mutual interest are planned especially with the hire of Prof. Lawrence Krauss this year.

As the Particle Physics and Astrophysics Group is reconstituted over the next few years, my focus is on maintaining the cohesiveness of the group, not only intellectually, but also for the purposes of maintaining unified and comprehensive funding. We are especially interested in moving beyond the traditional areas of the ASU group's expertise (hadron physics) into 21st-Century topics. To summarize, currently there is a very fertile soil for the growth of a dynamic particle and astroparticle physics program at ASU. The subsequent hires will provide an exciting future for ASU and a tremendous opportunity to greater prominence in particle physics.

I plan to maintain active research and explore further funding opportunities as well as to sustain a busy travel schedule to scientific conferences, seminars and meetings, whenever it does not interfere with my teaching duties, and continue to expose and publicize my research so as to increase the visibility of ASU as a whole.

Teaching: Please see enclosed "Teaching Statement".

Service: Since I joined the Department in 2004, I was appointed to the Graduate Examination and Graduate Program Committees (GPC). This was tremendously helpful since I taught first year graduate students and this assignment allowed me to get to know the graduate program and students in great detail. The Graduate Program Committee (GPC) was, by far, the most demanding of the assignments, but also extremely informative. At the time I served on the Committee the Department was going through the change of the graduate curriculum and the committee was charged with evaluating different possibilities for the future of the Graduate

Program in Physics. This also enriched me with excellent insight into the structure of graduate programs in the nation. With the completion of my term on the GPC in Spring 2006, I was appointed to the Colloquium Committee which I consider as an outstanding opportunity to help to shape up the colloquium program which provides a great deal of enrichment to students and faculty and to provide an interdisciplinary forum for exploring and discussing issues in different branches of physics as well as to provide a broader impact by educating the public.

With start up funds lasted, I was able to sustain for a year a biweekly seminar in Particle and Nuclear Physics at the Department of Physics. This was an outstanding service for our students who were exposed to internationally and nationally acclaimed physicists. In the Spring 2008, with funds provided by the Department of Physics, I co-organized bi-weekly series in Particle Physics and Astrophysics.