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PERSONALIA

In memory of Adilet Imambekov

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A brilliant young physicist, Adilet Imambekov, died on July 18, 2012 while climbing Khan Tengri mountain in Kyrgyzstan. Adilet was a rising star in the field of quantum many-body physics. Despite his young age, Adilet made several key contributions to the field of strongly correlated systems, in particular, developing a new conceptual framework for describing universal dynamics of one-dimensional quantum systems. Adilet's work was distinguished by a combination of deep physical insight, mathematical rigor, and elegance.

Born in 1981, Adilet spent his childhood years in Zhambyl and Almaty in Kazakhstan. His extraordinary abilities were evident at a very young age: after winning National Kazakhstan physics and mathematics competitions at the age of 14, Adilet entered Kolmogorov lyceum in Moscow — perhaps the best science high school in the former Soviet Union, attracting some of the most talented students from all over the country. The standard of the lyceum was so high that Adilet became the first student in 14 years to graduate with the highest honors, excelling not only in physics but also in subjects such as Russian literature and language (which was not even his mother tongue). Adilet also was a highly decorated physics Olympiads competitor, adding first place in the National Russian Olympiad in 1997 and 1998, and a Gold Medal at the 1998 International Physics Olympiad in Iceland to the list of his trophies.

Adilet continued his studies in Moscow Institute of Physics and Technology. In his junior year, he passed several exams of the Landau's Theoretical Minimum, and was admitted to the Theoretical Group at Landau Institute, where he received his basic training in theoretical physics.

At Landau Institute Adilet also started doing research with Prof. Gordey Lesovik, working on the problem of dissipative quantum systems. Adilet's thesis work turned into his first journal publication. Adilet received Bachelors *degree summa cum laude* in 2002.

After coming to Harvard in 2002 for his PhD studies Adilet started research in the group of one of us (ED), concentrating on many-body physics of cold atoms. His first work predicted a number of exotic states for bosons with non-zero spin residing in an optical lattice. Adilet's work opened a rich field, and up to these days it serves as a guide to experiments. Already during graduate school, Adilet developed a unique ability of using a fusion of ideas from solid state physics, atomic physics, and mathematics in his work. In some cases this allowed him to make progress in difficult problems where other attempts failed. One representative example was developing a new theoretical approach to the problem of interference between low-dimensional Bose condensates. The key insight of Adilet's work was an introduction of a new class of field theory models, and developing a nonperturbative approach for calculating partition functions of such models. The latter was done by a beautiful mapping to a seemingly unrelated problem of statistical properties of random surfaces. His theoretical analysis was crucial for the success of subsequent experiments, which explored the statistics of thermal and quantum fluctuations of one-dimensional condensates and demonstrated a new universal dynamical phenomenon — prethermalization.

Adilet Imambekov
(01.01.1981 – 18.07.2012)

Adilet commanded a unique combination of mathematical intuition with deep insight into the physics of quantum phenomena. Coming to Yale University to work with LG as a postdoc in 2007, he became interested in the dynamics of one-dimensional quantum fluids. The conventional description of such fluids is provided by the widely-known Luttinger liquid theory. It simplifies the problem by replacing a generic energy-momentum relation for the constituent particles with

a linear one; this artificially-imposed symmetry distorts the true dynamic response functions of a fluid. Adilet have made crucial contributions in building a theory free of artificial assumptions. Combining the existing perturbative results with his own analysis of an integrable Lieb–Liniger model, he managed to foresee the emerging universal dynamic properties of a fluid. Guided by the insight, in less than a year he built the nonlinear Luttinger liquid theory (term coined by Adilet) which gave a complete and universal description of low-energy excitations of a fluid made of particles with a generic spectrum. The beauty of that theory is in its simplicity and versatility. It answered the existing questions about the dynamic responses right away, at the same time providing a suitable platform for tackling other, possibly more difficult issues. Adilet had wonderful ideas on how to use the tools he developed for building theory of quantum quenches and kinetic theory of nonlinear Luttinger liquid. He was developing these two directions, in big strides, while starting his career as a junior faculty at Rice University.

Remarkably, the challenges a tenure-track faculty faces did not change Adilet a bit. He remained a warm, open person with a perfect pitch in physics. He quickly forged collaborations with his colleagues at Rice University, venturing into new for him area of solid state optics. Adilet was always ready to discuss problems he was finding interesting, and each of us cherished every opportunity to talk to or collaborate with Adilet. Discussions with Adilet were always lighted by his wonderful sense of humor and his eagerness to brighten even the most challenging and confusing physics topic by an unexpected joke.

Whatever Adilet became interested in, he pursued with utmost commitment. As an example, he became interested in climbing, mountaineering and endurance sports relatively recently, at the beginning of his graduate school. Right away, he started training nearly every day, running along Charles River in Cambridge, using every chance to rock climb in Romney, NH, and reading on how to achieve best results. Within just a few years, Adilet became a rather well known climber, who conquered two very challenging mountains in Alaska and China. He also qualified for Boston marathon twice, and won his first and last full Ironman triathlon competition in May, 2012.

Many of Adilet's close friends were guided by his commitment and love of life. Ultimately, he inspired his friends to pursue their own dreams and hobbies (although he often did try to drag them along to his rock climbing and hiking adventures). By his own example, he showed that little is impossible if you have enough dedication and interest.

One of the last things that Adilet said to one of us while discussing a joint project before going to his last trip in Kyrgyzstan was: "You should strive to solve the most challenging problem and get a result which is most valuable from the intellectual point of view, instead of putting a lot of effort in trying to publish every paper in the best possible journal. There is simply too little time." Indeed, Adilet was given very little time. But it was enough for him to make a long-lasting contribution to physics and to deeply affect the lives of people who were lucky to know him.

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