THE ICTP PRIZE

The ICTP Prize sculpture consists of a plaque emerging out of stone, symbolizing the emergence of new, refined knowledge. The stone base is made of Aurisina marble, which has been quarried in the vicinity of Trieste for more than 2000 years. The special kind of stone and the waves represent Trieste's setting between the karstic hills and the sea.

The Abdus Salam
International Centre
for Theoretical Physics

2012 ICTP PRIZE CEREMONY

8 July 2013

2012 ICTP PRIZE

The 2012 ICTP Prize in honour of Marshall N. Rosenbluth is awarded to Argentinean physicist **Pablo Mininni**, Facultad de Ciencias Exactas y Naturales, Universidad de Buenos Aires (UBA).

The Prize recognizes Professor Mininni's important contributions to advancing the understanding of fluid and magnetofluid turbulence at a fundamental theoretical level as well as working out a myriad of applications in astrophysics and atmospheric sciences. The former, inter alia, includes probing the structure of nonlinear interactions and the ensuing cascades of energy and other ideal invariants, and the latter spans a wide spectrum of problems such as the solar cycle, turbulent dynamos, magnetic reconnection, rotating flows, and stratified turbulence. His work has made a strong impact on this very active field.

Marshall N. Rosenbluth (1927-2003) received his doctorate from the University of Chicago in 1949, under the guidance of Edward Teller, with whom he would re-join a year later to provide theoretical guidance on nuclear fusion at Los Alamos National Laboratory. In between he took a postdoctoral appointment at Stanford University, which resulted in the so-called "Rosenbluth formula" that Robert Hofstadter mentioned in his 1961 Nobel lecture. In 1953, Rosenbluth played a central role in developing the Metropolis algorithm, generally regarded as the most successful and influential of the Monte Carlo schemes developed in the 20th century. Most of his career, however, was devoted to plasma physics and to the theoretical developments needed to harness nuclear fusion as a source of energy. In this effort he recognized that small scale instabilities in plasmas, including turbulence, were important problems to be understood and he centered much of his attention in this area in later years. In 1964, with the encouragement of Abdus Salam, he organized the newly-formed ICTP's first activity: a plasma physics workshop that would gain historical significance by bringing together in Trieste leading plasma physicists from the Soviet-block and Western countries.

2012 ICTP Prize Committee
- P. Creminelli
- L. Göttsche
- F. Kucharski
- M. Marsili (Chair)

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Main Lecture Hall, Leonardo Building

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Programme

11:00 Remarks by Fernando Quevedo, Director, ICTP

11:10 Remarks by Harry Swinney (University of Texas at Austin) on Marshall N. Rosenbluth

11:20 Presentation of the award

11:30 ICTP Prize Lecture by Pablo Mininni
Role of Helicity in Turbulent Flows

Invariants of the equations of motion play an essential role in the behavior of turbulent flows. The cascade of energy to small scales in three dimensional hydrodynamic turbulence, associated with the conservation of energy in the ideal case, is a well-known example. Less understood is the role played by the helicity, which embodies the global correlations between the velocity field and the vorticity. Helicity is a curious invariant of the Euler equations in three dimensions, which measures topological complexity of the flow and departures from mirror symmetry, but which is also observed to play an important role in the generation of large-scale magnetic fields in astrophysics, and hypothesized to play roles in atmospheric processes.

In this talk, I will present some situations in which helicity is believed to be important, and try to identify its effect on the flow evolution. In particular, I will present results from large direct numerical simulations of rotating and/or stratified turbulent flows. In the case of rotating flows, helicity in the flow affects scaling laws and the mixing of scalar quantities. In stratified and rotating flows, helicity emerges spontaneously from the joint action of eddies and of inertia-gravity waves. Extensions of these results to other systems, and possible experimental measurements, will be briefly discussed.