

Selected Career Highlights

2017 Main Organiser, School of Physics Les Houches (forthcoming)
2016 Prize for Best Presentation, Frontiers in Nonlinear Physics conference, Russian Academy of Sciences
2016 Invited speaker, Solvay Workshop Nonequilibrium and nonlinear phenomena in statistical mechanics
2015 ERC Fellow
2013 Main Organiser of the Scientific Programme “Mathematics of Fluid Earth” at the Isaac Newton Institute for Mathematical Sciences, Cambridge, UK.
2013 Responsible person, London Mathematical Society, Mathematics of Planet Earth initiative.
2013 Highlight Paper for Nonlinearity
2010 EGU „Outstanding Young Scientist Award for major contributions to the understanding of multiscale variability in chaotic dynamical systems and the application of these ideas to meteorology and climate.
2006 Alessandro Volta Prize, Centro di Cultura Scientifica Alessandro Volta, Italy.
2003 Scholarship by the Finnish Academy of Arts and Letters.
2001 Global Change Fellowship, American Meteorological Society.
2000 Charney Prize, Massachusetts Institute of Technology, Cambridge, MA, USA.
2000 Excellence Award, Best Young Researcher, Italian Physical Society.
1995–1999 Scholarship by Scuola Normale Superiore, Italy.

Selected Funding ID

2016-2020 Co-PI (one of 41) of the EU Horizon2020 Project Blue Acton (7.5 M€)
2016-2019 Co-PI (one of 4) of the Belmont Forum Project BITMAP (1.4 M€)
2016-2020 Co-Pi (one of 25) of the German SFB/Transregio DFG Project “Energy Transfers in the Atmosphere and Ocean” (10 M€)
2015-2019 Co-Pi (one of 25) of the EU Horizon2020 Project CRESCENDO (13 M€)
2015-2018 PI of the DFG Project MERCI (150 K€)
2015-2017 Co-PI (one of 6) EU Climate-KIC Project WInNERS (1.6 M€)
2015-2019 Co-PI (one of 3) DWD Ertel Center on Atmospheric Convection ARCS (900 k€)
2015-2018 PI (sole beneficiary) FP7 Marie Curie project SPARCS (280 k€)
2013-2017: Co-PI, Mathematics for Planet Earth Center for Doctoral Training, UK (5 M€)
2013-2016 PI (sole beneficiary) EU Climate-KIC PhD project Extremes In South Asia (260 k€)
2012-2017 Co-PI (one of 25) of the German DFG Cluster of Excellence CLISAP2 (33M€)
2010-2015 PI (sole beneficiary) FP7-ERC Grant NAMASTE-Thermodynamics of the Climate System (1.4 M€)

Extended Scientific Visits

2014-2016 Visiting Professor, Russian Academy of Sciences, Inst. Num. Maths. (Moscow, RU).
2015 Indian Institute of Technology (Delhi, IN)
2015 Indian Institute of Tropical Meteorology (Pune, IN)
2012-2013 Visiting Professor, Chinese Academy of Sciences, Inst. Atm. Physics (Beijing, PRC).
2011 Visiting Professor, Russian Hydromet. State University (St. Petersburg, Russia).
2008 Centre for Mathematical Research (Marseille, France).
2007 Institut Poincare, (Paris, FR).

Research Areas

Instabilities in fluid flows, Statistical Mechanics of Geophysical Systems, Nonlinear Dynamics, Response theory for chaotic systems, Turbulence, Mathematical Theory of Extreme events and applications, Climate Dynamics, Climate Thermodynamics, Climate Models auditing, Climate Change Impacts

Scientific Highlights

- Statistical mechanical formulation of climate change and climate response using response theory for non-equilibrium steady state systems; climate prediction in general circulation models; unified view of smooth response, behavior near critical transitions, multistable behavior; introduction of the concept of Melancholia state
- Extension of the response theory for studying the impact of stochastic perturbations, for non-smooth observables and for constructing parametrizations for multiscale systems;

- New point of view on geophysical fluid dynamical instabilities using the formalism of covariant Lyapunov vectors; new dynamical interpretation of blocking events;
- Development of Extreme Value Theory for dynamical systems; application of the theory in geophysical contexts; extremes as fingerprints of critical transitions; response of extremes to perturbations in the dynamics of a system; extremes and climate risk
- New theoretical framework for the thermodynamics of the climate system and of planetary atmospheres; energy transfer mechanisms; entropy production in the climate system; efficiency and irreversibility of the climate engine; study of climatic tipping points;
- Assessment of the performance of global circulation models in the representation of the hydrology of the Indian and South-East Asian Monsoon region
- New laws for nonlinear optics, definition of dispersion relation for harmonic generation and pump-and-probe experiments; new tools for optical material research