2024 Birkhäuser Distinguished Lecture

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Lecturer:	**Professor Camillo De Lellis, IAS, Princeton**
Title:	**Flows of nonsmooth vector fields**
Date:	**Monday, December, 9th, 2024**
Time:	**08:30 New York**
	13:30 London
	14:30 Berlin
	15:30 Cairo
	16:30 Baghdad
	19:00 New Delhi
	21:30 Beijing
	22:30 Tokyo
Zoom link:	**https://springer.zoom.us/j/86946520694**

ABSTRACT Consider a vector field v on the Euclidean space. The classical Cauchy-Lipschitz (also named Picard-Lindelöf) Theorem states that, if the vector field is Lipschitz in space, for every initial datum x there is a unique trajectory γ starting at x at time 0 and solving the ODE $\dot\gamma(t) = v(t, \gamma(t))$. The theorem looses its validity as soon as v is slightly less regular. However, if we bundle all trajectories into a global map allowing x to vary, a celebrated theory started by DiPerna and Lions in the 80es shows that there is a unique such flow under very reasonable conditions and for much less regular vector fields. This has a lot of repercussions to several important partial differential equations where the idea of "following the trajectories of particles" plays a fundamental role. In this lecture I will review the fundamental ideas of the original theory, outline an alternative approach due to Gianluca Crippa and myself, and point out to several counterintuitive situations, discovered in recent years, when the fields are too irregular to apply the theory. If time allows I will explain a recent joint work with Elia Brué in which we apply these ideas to the forced Navier-Stokes equations.

BIO Camillo De Lellis was born in 1976 in San Benedetto del Tronto, Italy. After earning his undergraduate degree in mathematics at the University of Pisa in 1999, he wrote his doctoral dissertation in 2002 under the supervision of Luigi Ambrosio at the Scuola Normale Superiore di Pisa. He joined the faculty of the University of Zürich in 2004 as Assistant Professor of Mathematics, and was appointed Full Professor in 2005. In 2018 he moved to the Institute for Advanced Study in Princeton, where he holds the IBM von Neumann Professorship. He is active in the fields of calculus of variations, geometric measure theory, hyperbolic systems of conservation laws, and fluid dynamics. He has been a plenary speaker at the European Congress of Mathematics in 2012 and at the Inernational Congress of Mathematicians in 2022. He is a member of the Academia Europaea, of the German Academy of Sciences, and of the American Academy of Arts and Sciences.