LONDON MATHEMATICAL SOCIETY
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Whitehead Prize: citation for Ewelina Zatorska

Short citation:

Professor Ewelina Zatorska of the University of Warwick is awarded a Whitehead Prize for her outstanding work in the field of nonlinear partial differential equations. She has made deep and lasting contributions to the mathematical theory of the compressible Navier–Stokes equations and other nonlinear PDEs. Her results on existence, regularity and asymptotic limits of solutions are at the forefront of current research developments in this area.

Long citation:

Professor Ewelina Zatorska (University of Warwick) is awarded a Whitehead Prize for her pioneering contributions to the theory of nonlinear partial differential equations, particularly in the mathematical analysis of compressible fluid flows.

A large body of Professor Zatorska's work is devoted to the study of weak solutions to time-dependent models of compressible flows, ranging from mixtures and multi-phase fluids to hydrodynamic models of interacting agents. Her most impactful results concern the compressible Navier–Stokes equations— the fundamental system of nonlinear partial differential equations of fluid dynamics. She has made major advances in understanding existence and regularity questions in this area, establishing herself as a leading international expert. Within the UK, she is one of a very small number of researchers to have made substantial and original contributions to this domain.

In her landmark single-author paper *"On the flow of chemically reacting gaseous mixtures"*, she addressed the Cauchy problem for systems governing isothermal reactive mixtures of compressible gases. The paper's central result is the proof of sequential stability of weak solutions under a physically relevant setting where the equation of state depends on species concentration and both bulk and shear viscosities degenerate at vacuum. She also established the existence of global weak solutions for arbitrarily large initial data.

Her impressive two-part work *"Two-velocity hydrodynamics in fluid mechanics"*, co-authored with Bresch and Giovangigli (Part I) and with Bresch and Desjardins (Part II), initiated the studies on two-velocity hydrodynamic formulation of barotropic compressible flows with degenerate viscosities. These papers introduced a new class of entropy solutions and rigorously analyzed the associated zero Mach number limits—opening new directions in the study of degenerate fluid models.

Professor Zatorska has also extended her expertise to models of collective dynamics. Her recent work explores the mathematical underpinnings of dissipative Aw–Rascle system used in pedestrian motion modeling and nonlocal Euler-type equations for interacting agent systems. Her contributions encompass existence results for measure-valued solutions, weak–strong uniqueness principles, long-time asymptotics of solutions, and the analysis of hard congestion limits—demonstrating both technical mastery and remarkable breadth.

Professor Zatorska's work combines deep mathematical insight with strong physical motivation and continues to shape the modern mathematical theory of fluid flows and collective dynamics.