

Singularities of solutions to Hamilton-Jacobi equations: from PDE's to topology, passing through geometric measure theory

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The study of the structural properties of the set of points at which a solution u of a first order Hamilton-Jacobi equation fails to be differentiable -in short, the singular set of u - has been the subject of a long-term project that started in the late sixties with a seminal paper by W. H. Fleming. Research on such a topic picked up again after the introduction of viscosity solutions by M.Crandall and P.-L. Lions in the eighties and is still ongoing. All these years have registered enormous progress in the comprehension of the size and structure of singularities. First, several authors, including Luigi Ambrosio, contributed to develop a fine measure theoretical analysis of the singular set. Then, the dynamics governing propagation of singularities was identified, and connections with weak KAM theory by A. Fathi were pointed out. This effort also led to interesting topological applications. In this talk, I will revisit some of the milestones of the theory and describe its recent achievements.

Presenter: CANNARSA, Piermarco (Università degli Studi di Roma Tor Vergata)