Kenji Fukaya

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Kenji Fukaya is an extraordinary geometer who foresees important ideas and the directions of future research. He has proved fundamental results and stimulated research areas that have attracted the attention of many mathematicians. Fukaya is very vigorous and open to discussions on any research subjects in mathematics. He listens to people patiently. He prefers deep, original ideas rather than fashionable subjects.

Fukaya's early works were on Riemannian geometry. In the 1970s, M. Gromov introduced a new viewpoint to study Riemannian manifolds, namely, the Gromov–Hausdorff spaces, which revolutionized Riemannian geometry. Fukaya made many important contributions to understanding the structure of manifolds that converge in Gromov–Hausdorff topology and their limits. For example, with J. Cheeger and M. Gromov [3], he established a unified approach to collapsing theory with sectional curvature bounds. With T. Yamaguchi [20], he gave a satisfactory description of the structure of almost nonnegatively curved manifolds.

In the 1980s, while studying the Laplacian spectrum under Gromov–Hausdorff convergence, Fukaya introduced the notion of measured Gromov–Hausdorff convergence and obtained continuity results on the spectrum (see [7]). He was one of the first to realize the importance of this setting, and now many mathematicians are working within the framework of metric measure spaces.

Fukaya has made significant contributions to gauge theory, symplectic geometry, and mirror symmetry. In the mid-1980s, Floer initiated semi-infinite-dimensional Morse theory, which is now called *Floer theory*, in the contexts of the action functional associated with Lagrangian intersections (Lagrangian Floer theory) and the Chern–Simons functional for SU(2)-connections on integral homology spheres (instanton homology theory) (see [5], [6]).

The famous Atiyah–Floer conjecture states that instanton homology is isomorphic to the Floer theory of intersections of Lagrangian subspaces associated with handlebodies appearing in the Heegaard splitting of the homology 3-sphere. One may also study instanton homology theory for 3-dimensional manifolds with boundary, which are more general than handlebodies.

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