Categorification of invariants in gauge theory and symplectic geometry*

Kenji Fukaya

Received: 20 November 2016 / Revised: 21 July 2017, 3 September 2017 / Accepted: 15 September 2017
Published online: 30 November, 2017
© The Mathematical Society of Japan and Springer Japan 2017

Communicated by: Kaoru Ono

Abstract. This is a mixture of survey article and research announcement. We discuss instanton Floer homology for 3 manifolds with boundary. We also discuss a categorification of the Lagrangian Floer theory using the unobstructed immersed Lagrangian correspondence as a morphism in the category of symplectic manifolds.

During the year 1998–2012, those problems have been studied emphasizing the ideas from analysis such as degeneration and adiabatic limit (instanton Floer homology) and strip shrinking (Lagrangian correspondence). Recently we found that replacing those analytic approach by a combination of cobordism type argument and homological algebra, we can resolve various difficulties in the analytic approach. It thus solves various problems and also simplify many of the proofs.

Keywords and phrases: Floer homology, $A_\infty$ category, Yang–Mills equation, Lagrangian submanifold, gauge theory, pseudo holomorphic curve

Mathematics Subject Classification (2010): 57R58, 57R57, 57R56, 53D37, 53D40

* This article is based on the 17th Takagi Lectures that the author delivered at Research Institute for Mathematical Sciences, Kyoto University on June 18, 2016.

KENJI FUKAYA
Simons Center for Geometry and Physics, State University of New York, Stony Brook, NY 11794-3636 U.S.A. and Center for Geometry and Physics, Institute for Basic Sciences (IBS), Pohang, Republic of Korea (e-mail: kfukaya@scgp.stonybrook.edu)