

Gavin Brown Best Paper Prize for 2021 (2)

Authors: B Parker

Title: Holomorphic curves in exploded manifolds: virtual fundamental class

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The paper “Holomorphic curves in exploded manifolds: virtual fundamental class” is the culminating paper in a series of papers detailing a remarkable new theory of exploded manifolds which Parker has been methodically building over more than 15 years. This is a gigantic and profound project. At least 13 of Parker’s papers, in total around 600 pages, are devoted to a systematic exploration of different sides of this new theory.

In this paper Parker is finally able to use all the developed machinery for the construction of Gromov-Witten invariants of exploded manifolds; even in the category of smooth symplectic manifolds, this construction is notoriously difficult, with several errors in the earlier published literature. The resulting gluing formula for Gromov-Witten invariants in itself is a major achievement.

Parker’s new theory can be seen as a far-going generalization of tropical geometry. In fact, it relates to tropical geometry in a similar way as Gromov-Witten theory for symplectic manifolds relates to enumerative algebraic geometry. The theory of exploded manifolds seems to provide the right language for describing the behaviour of holomorphic curves in a large spectrum of different situations when the ambient almost complex structure degenerates in certain ways. Parker’s results using exploded manifolds have already spawned a copy in the world of logarithmic algebraic geometry, where logarithmic schemes play the role of exploded manifolds. The current advances towards a gluing formula for logarithmic Gromov-Witten invariants are inspired by the exploded manifold version.

The paper was unanimously recommended for the Gavin Brown Prize by the assessors. In the words of one of the assessors: “I believe that Parker has done impressively original work and difficult work. It shows mastery of many aspects of symplectic geometry. Parker’s program is having significant impact on the field. I can certainly recommend the nominated paper for the Gavin Brown prize in the strongest possible terms.”