Gavin Brown Best Paper Prize
2021

Brett Parker (ANU)

Holomorphic curves in exploded manifolds: virtual fundamental class
Geometry & Topology **23** (2019), 1877–1960

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 diffcult, 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."