

2019 E.H. Moore Research Article Prize

CIPRIAN MANOLESCU was awarded the 2019 E. H. Moore Research Article Prize at the 125th Annual Meeting of the AMS in Baltimore, Maryland, in January 2019.



Ciprian Manolescu

Citation

The 2019 E. H. Moore Research Article Prize is awarded to the paper “Pin(2)-equivariant Seiberg–Witten Floer homology and the triangulation conjecture” by Ciprian Manolescu, published in the *Journal of the American Mathematical Society*; 29 (2016), no.1, 147–176.

This paper resolves the Triangulation Conjecture, showing that there are topological manifolds that do not admit a simplicial triangulation in each dimension greater than 4. This is achieved by introducing Pin(2)-equivariant Seiberg–Witten Floer homology to give homology cobordism invariants of oriented homology 3-spheres, including an integral lift of the Rokhlin invariant which is negated by taking the mirror image (reverse orientation). The new invariants are powerful enough to show that there does not exist a homology 3-sphere with Rokhlin invariant 1 which is homology cobordant to its mirror image. In turn, this implies the existence of non triangulable manifolds in dimensions 5 and higher by the work of D. E. Galewski and R. J. Stern and of T. Matumoto. Note that it was known before that 2- and 3-dimensional manifolds are triangulable, and there are 4-manifolds which do not admit a triangulation, thus resolving the triangulation question in all dimensions.

One expert referred to this as a “landmark article.” Moreover, the techniques from the paper are already being applied to answer other questions in low-dimensional topology, for example regarding the homology cobordism

groups, and inspired a related theory of involutive Heegaard Floer homology.

Biographical Sketch

Ciprian Manolescu was born in Romania in 1978. He received his BA in 2001 and his doctorate in 2004, both from Harvard University. After appointments at Princeton University, Columbia University, and the University of Cambridge, he joined the University of California, Los Angeles, where he is now a professor. He was previously awarded the Frank and Brennie Morgan Prize, a Clay Research Fellowship, and a European Mathematical Society Prize. In 2017 he became a Fellow of the American Mathematical Society, and in 2018 he gave an invited talk at the International Congress of Mathematicians.

Response from Ciprian Manolescu

I feel very honored to receive the E. H. Moore Research Article Prize from the AMS. The main result of the paper is the existence of non triangulable manifolds in dimensions at least 5. In principle, a low-dimensional topologist like me could have no hope of proving such a result. Luckily, in the 1970s, David Galewski, Ron Stern, and Takao Matumoto managed to reduce this statement to a conjecture about the homology cobordism group in dimension 3, and this is the conjecture I proved. They deserve more than half of the credit for the final theorem. I would like to thank my mentors Peter Kronheimer, Mike Hopkins, and Lars Hesselholt. With their help, during my student years at Harvard I developed a stable homotopy version of Seiberg–Witten Floer homology. I found a few applications for this construction back then, but the theory lay more or less dormant for the next decade. In 2012 I started thinking about homology cobordism, and I then realized that by

incorporating an extra symmetry into my old construction I could get new information. The result was the article cited for this award. I am happy to see that, in the past few years, several young mathematicians have further developed the techniques from my paper to yield even more insight into homology cobordism. I would particularly like to acknowledge the contributions of Irving Dai, Kristen Hendricks, Jennifer Hom, Tye Lidman, Francesco Lin, Jianfeng Lin, Matt Stoffregen, Linh Truong, and Ian Zemke. It was a pleasure having some of them as collaborators and students. Finally, I want to thank my colleagues at UCLA for making the department a great place to do research.

About the Prize

The E.H. Moore Research Article Prize is awarded every three years for an outstanding research article that appeared in one of the primary AMS research journals: *Journal of the AMS*, *Proceedings of the AMS*, *Transactions of the AMS*, *AMS Memoirs*, *Mathematics of Computation*, *Electronic Journal of Conformal Geometry and Dynamics*, or *Electronic Journal of Representation Theory*. The article must have appeared during the six calendar years ending a full year before the meeting at which the prize is awarded. The prize carries a cash award of US\$5,000.

The prize honors the extensive contributions of E. H. Moore (1862–1932) to the AMS. Moore founded the Chicago section of the AMS, served as the Society's sixth president (1901–1902), delivered the Colloquium Lectures in 1906, and founded and nurtured the *Transactions of the AMS*.

The E.H. Moore Research Article Prize is awarded by the AMS Council acting on the recommendation of a selection committee. For the 2019 prize, the members of the selection committee were:

- Ian Agol (Chair),
- F. Michael Christ,
- Sergio Roberto Fenley,
- Nets H. Katz,
- Claire Marie Voisin.

A list of previous recipient of the E.H. Moore Research Article Prize may be found on the AMS website at <https://www.ams.org/profession/prizes-awards/pabrowse?purl=moore-prize>.

Credits

Photo of Ciprian Manolescu is courtesy of Reed Hutchinson.