

Five-year impact statement
Program on Homological Mirror Symmetry

Retrospectively, the program marked a turn in the subject, away from proving the Homological Mirror Symmetry conjecture for specific classes of manifolds, and towards new directions, such as:

Functoriality and gluing for Fukaya categories, allowing one to build a more systematic picture of Homological Mirror Symmetry. “The main outcome of my IAS visit was to shift focus from explicit calculations to [more structural questions](#)” (Denis Auroux). This tendency is clearly visible in Abouzaid’s work on [family Floer homology](#), and Ganatra-Pardon-Shende’s on Liouville sectors. “Both my collaborators Sheel Ganatra and Vivek Shende spent time at the program. We developed the key ideas of our [paper](#) *sectorial descent for wrapped Fukaya categories*. I taught a mini-course focused on Liouville sectors and locality in Fukaya categories” (John Pardon).

The interaction of Homological Mirror Symmetry with other geometric methods, such as tropical and nonarchimedean geometry, which appears in various forms in the work of Arguz, Mak, Ruddat, Keel, Yu, Sheridan. . . ; and, in a different direction, the theory of constructible sheaves. “I gave a mini-course on the non-archimedean approach to mirror symmetry, and Sean Keel gave one on theta functions and cluster algebras. It was a great opportunity for us to discuss relations between the non-archimedean approach and the scattering-diagram approach, and we managed to [combine our ideas](#)” (Tony Yue Yu).

Postdoc: Hülya Argüz (PhD 2016). “Interacting with experts in mirror symmetry, both from the algebro-geometric and the symplectic side, enabled me to branch out. Many of my articles written later on address questions that hit my thoughts during the program. I also had the chance to engage in activities in neighbouring universities, and to give seminar talks [...] I felt visible, and at the end, I left campus armed with new knowledge, skills, and enthusiasm.”



Hülya Argüz

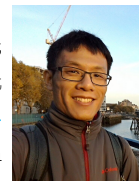
Collaborators: Nicholas Sheridan (PhD 2012) and Sheel Ganatra (PhD 2012). Sheridan: “During the IAS program, I learned about the Gamma conjectures in mirror symmetry; the collaboration leading to the paper [The Gamma and Strominger-Yau-Zaslow conjectures](#) (with Abouzaid, Ganatra, and Sheridan) was initiated by Hiroshi Iritani’s visit to the IAS. We are generalizing these results in ongoing work, and a side project has grown out of it which I plan to give to a PhD student.” Ganatra: “I studied the origin of interesting constants, such as zeta values, in mirror symmetry. With Abouzaid, Iritani, and Sheridan, we proposed the first geometric explanation of such phenomena. I have continuing conversations about pushing these techniques further.”

The program was largely structured around mini-courses and reading/working groups organized by participants. The reading groups seem to have made a particularly deep impact, including on graduate students:

- “I ran a seminar on symplectic methods in knot invariants. We had lots of involvement from graduate students and postdocs” (John Pardon).
- “I learned about mirror symmetry for K3 surfaces, through the reading group I helped run. This was important for my [paper](#) *Symplectic topology of K3 surfaces via mirror symmetry*” (Nick Sheridan).
- “Several graduate students were active in IAS reading groups (Sara Venkatesh, Umut Varolgunes, Baris Kartal). Subsequently, I began a collaboration with Venkatesh and Yuan Gao. I also organized, and learned quite a lot from, a reading group about the Gamma conjectures in mirror symmetry” (Sheel Ganatra).
- “Material I learned from the Hodge-to-de Rham working group has been very useful in my research” (Tony Yue Yu).

Graduate student: Sara Venkatesh (PhD 2018). “The IAS 2016-17 program gave me unique access to a large community of experts in Homological Mirror Symmetry. Joining this community sparked exciting connections between my thesis work and mirror symmetry, leading to a new avenue of problems I am still actively exploring, and it laid foundations for collaborations that I continue to maintain.”

Collaborators: Cheuk-Yu Mak (PhD 2016) and Helge Ruddat (PhD 2008). Mak: “The program at IAS was undoubtedly the most important period for my entire research career so far. I started a [collaboration](#) with Helge Ruddat [...] I met a lot of people in field, including Ivan Smith (who became my mentor at Cambridge, where we collaborated on a [project](#) using what I learnt in one of the IAS seminars) and Nick Sheridan (my current mentor).” Ruddat: “[The program] introduced me to Cheuk-Yu Mak, and to the idea that the mirror duals of the lines on the quintic should produce interesting lens spaces. Cheuk Yu and I began to work on this problem, which took two years to complete. I talked to Mohammed Tehrani and Mohammed Abouzaid about maximal degenerations from the symplectic perspective, and it informed my work with Cheuk Yu.”



Cheuk-Yu Mak



Helge Ruddat