

Acknowledgements

We are delighted to present the 2025 edition of HLMA Winning Papers, celebrating the remarkable journeys and stellar achievements of our young students.

First and foremost, I would like to express my sincere gratitude to Professor Richard Schoen, a Wolf Prize Laureate and world-renowned expert in Differential Geometry, for continuing to chair the Scientific Committee and for his unwavering leadership in upholding the intellectual excellence and integrity of HLMA. The Scientific Committee also includes members who have served on the Fields Medal Committee in the past, and some are renowned worldwide for their contributions to resolving frontier problems in mathematics, including Fermat's Last Theorem, the Positive Mass Theorem, and the Kakeya Conjecture.

Similar to previous years, the adjudication process is highly rigorous and comparable to that of academic journals. Over the past two years, we have witnessed the rapid advancement of generative AI tools, which has brought new opportunities as well as important questions about what constitutes as fair and responsible use of such technologies in mathematical research. In HLMA, our guidelines allow teams to seek opinions and accept guidance from others, but the actual research work must be done by the students themselves, and each team member is expected to truly understand the content of their project. Any methods, results, or significant ideas originating from others must be properly documented in the references of the report, and these expectations apply equally when students "consult" AI tools, whose contributions should be treated as external assistance rather than original work by the team. More so than ever, the oral defense is a crucial and effective component of the adjudication process, providing an opportunity for the Scientific Committee to meet the finalists in person and gauge the teams' true understanding of their work.

HLMA would like to pay tribute to the former Chair of the Steering Committee, the late Professor George F. Smoot and a Nobel Prize Laureate in Physics, who passed away in September 2025. We are also grateful that Professor Ngaiming Mok, a longstanding member of our Scientific Committee, has agreed to chair the Steering Committee. I am also deeply grateful to the Executive Committee, chaired by Professor Shing Yu Leung, and to the secretariat and colleagues from Hang Lung Properties, whose tireless efforts in administration, promotion, and organization make this competition possible year after year. I would also like to thank Chen Junyu, Nguyen Van Hoang, Benz Wong, and the winning teams for the assistance of the LaTeX-typeset of this volume.

The publication of this volume has once again been made possible by the generous support of Hang Lung Properties, and I hope that this eleventh collection of winning papers will continue to inspire students, teachers, and schools to explore mathematics through serious research and creative inquiry.

Frederick Tsz-Ho Fong

“The Scientific Committee was extremely impressed by this year’s presentations and the excellent quality of the papers. I am continually amazed at the sustained effort these secondary school students invest in, and at the remarkably high level they achieve. This is exactly what a strong mathematical foundation makes possible: clear reasoning, flexible thinking, and the ability to strip away complexity to model a problem simply and solve it well. Building a solid mathematical core equips students with powerful tools for further study, research, and the challenges ahead.”

Professor Richard Schoen

Chair, 2025 Hang Lung Mathematics Awards Scientific Committee
2017 Wolf Prize Laureate in Mathematics
Stanford University
University of California, Irvine

“It is encouraging to see students, through their own dedication and with the support of committed teachers, take on research topics that were once studied only at universities, and in some cases even at an early graduate level. Such achievements reflect a genuine spirit of inquiry. From year to year, students have been making clear gains in ability and confidence, and they have been learning to present challenging ideas with greater clarity and structure. It is deeply rewarding to witness such growth and to be reminded of what young minds can achieve when given the opportunity.”

Professor Ngaiming Mok

Chair, 2025 Hang Lung Mathematics Awards Steering Committee
2022 Future Science Prize Laureate in Mathematics
and Computer Science
The University of Hong Kong