

## **Laudatio Charles Kane, Lorentz Medal 2026**

11 December 2025

Dear Laureate, Esteemed Colleagues, Dear Guests,

It is an honour and a pleasure to present this Laudatio for Professor Charles Kane on behalf of the Jury. Professor Kane will shortly be receiving the Lorentz Medal 2026 from the Vice-President of the Royal Netherlands Academy of Arts and Sciences. The medal honours pioneering research in theoretical physics.

The Lorentz Medal is awarded once every four years. You may wonder why it is being presented one year early. The reason is truly festive: established exactly one hundred years ago in 1925, the Lorentz Medal marks its centennial today. Moreover, today's ceremony coincides with the date when, 150 years ago, Hendrik Antoon Lorentz received his PhD in mathematics and physics from Leiden University — on 11 December 1875. Lorentz, a Nobel laureate, is regarded as the founding father of theoretical physics in the Netherlands.

In the opinion of the jury, Charles Kane is a more than worthy recipient of the Lorentz Medal. The reason for bestowing this honour upon him is his visionary research into material properties at the quantum level. His work has fundamentally transformed how we classify and understand quantum materials.

Let me give you an idea of how his work has opened entirely new directions in physics.

Professor Kane is internationally acclaimed for his theoretical discovery of topological insulators. These materials possess the remarkable ability to conduct electricity on their surfaces while acting as electrical insulators in their interior. He made a breakthrough in this field in 2005 together with his close colleague Eugene Mele. They developed a theoretical framework predicting the quantum spin Hall effect — a new quantum state of matter with topological properties.

This insight soon led to the experimental realization of topological insulators, first in HgTe quantum wells and subsequently in many other materials since. This sparked the birth of a new field: the study of topological phases of matter, starting with topological insulators. Professor Kane can be regarded as one of the founders of this research.

A few years later, in 2007, Professor Kane made another key contribution to this field together with his PhD student Liang Fu. They proposed that coupling a conventional s-wave superconductor to a topological insulator could create a topological superconductor. They also showed that these materials could host Majorana particles. These exotic particles are promising candidates for fault-tolerant quantum computing. Majorana particles are a central topic in current research and have yet to be conclusively observed.

The jury emphasises that Professor Kane's work stands out for its originality, depth, and visionary character. He predicted entirely new phases of matter before they were observed. This is exceptional in the field of condensed matter physics, where most theoretical work follows experimental discoveries.

While Professor Kane's discoveries have potential applications in new technologies, his research is primarily curiosity-driven. He continues to raise new fundamental research questions to gain an even deeper understanding of how materials and electrons interact. Professor Kane has fundamentally changed the way we think about phases of matter. His predictions continue to shape the future of quantum materials and technologies.

Beyond his groundbreaking research, Professor Kane has distinguished himself as an exceptional teacher and mentor. He has taught physics courses at all levels. And the select group of students he has supervised, have gone on to become accomplished scientists in their own right. With his commitment to education, clarity of thought, and genuine intellectual engagement, Professor Kane stands as a truly inspiring figure within the academic community.

His impact is reflected in numerous citations and various prestigious awards. The jury considers the Lorentz Medal a truly fitting and well-deserved addition to this list of honours. We believe that Professor Kane embodies the spirit of this medal – through the excellence of his scientific contributions and the lasting impact of his contributions to our field. His work will influence physics for decades to come.

In recognition of his pioneering work in theoretical physics, the Royal Netherlands Academy of Arts and Sciences is proud to award the 2026 Lorentz Medal to Professor Charles Kane.

The 2025 Lorentz Medal Jury  
R.H. Dijkgraaf (Chair)  
A.R. Akhmerov  
M. Dijkstra