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Mathematical Sciences Colloquium

Enumerative Path Integrals

Professor

Pil-Jin Yi(KIAS)

May 19, 2022 16:00 - 17:15

>>>Venue(110-N103)<<<

Host

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Abstract

Index Theory, from thedays of Atiyah and Singer, remains one of more prominent tools for extracting topological and enumerative data out of geometrical objects. Physicists embraced the concept as early as 1980's and has successfully recast the machinery into quantum mechanics and quantum field theories, with a simple manifestation via the path integral. The path integral is often regarded as fuzzy and ill-defined object, especially under the rigor demanded by mathematicians, yet a precise formulation of it is capable of producing rigorous integer expressions that encode topological invariants of the underlying quantum physics, hence the title of the talk 'enumerative path integrals.' Its importance grew even further as we face superstring theories, ventually leading to the widely known statement of how only five different kinds of superstring theories are possible.

In this talk, after a brief introduction to the index theory from quantum viewpoints we will review a relatively modern development, commonly known as the localization, a sweeping generalization of the geometric index theory of Atiyah-Patodi-Singer to the realm of gauge theories, In particular, we will follow the M-theory hypothesis and the accompanying D0-brane bound state problems, from the pioneering insights by Witten in 1995. The latter problems took 20 years to be solved completely, assuring us once again that M-theory does exist and unifies all five superstring theories despite how this 11 dimensional theory is yet to be formulated in self-contained manner on par with superstring theories quantum field theories.

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