

# APCTP SEMINAR

## Spectral Properties of Relativistic Quantum Billiards versus those of Haldane Graphene Billiards

**Dr. Barbara Dietz**

*Institute for Basic Science*

**December 18 (Thu.) 16:00**

**#512, APCTP**

In distinction to nonrelativistic quantum billiards (QBs), relativistic neutrino billiards (NBs), which consist of a spin-1/2 particle governed by the Weyl (Dirac) equation and confined to a bounded planar domain, do not have a well-defined classical limit. Yet, their spectral density is well approximated by a semiclassical trace formula, that is, in terms of a sum over periodic orbits of the classical dynamics associated with the QB. This led to the question to what extent the Berry-Tabor & Bohigas-Giannoni-Schmit conjectures concerning the spectral properties of typical nonrelativistic quantum systems with an integrable and chaotic classical dynamics, respectively, apply to NBs. I will present some results and then come to graphene billiards (GBs), that is finite-size honeycomb lattices. It is well known that in the region of low-energy excitations around the Dirac points, where the dispersion relation is linear, the electronic properties of graphene are described by the same relativistic Dirac equation as NBs. Yet, GBs exhibit eigenstate properties of typical nonrelativistic QBs. I will demonstrate that, on the contrary, they comply with those of NBs for GBs subject to the Haldane-model on-site potential and next-nearest-neighbor tunneling at critical points.

### ■ Contact information

Host: Kyoung-Min Kim ([kyoung.kim@apctp.org](mailto:kyoung.kim@apctp.org))

Office: Research Support Team ([rs@apctp.org](mailto:rs@apctp.org))



The APCTP is supported by the Korean Government through the Science and Technology Promotion Fund and Lottery Fund and we strives to maximize public value through its various activities.

아시아태평양이론물리센터는 정부의 과학기술진흥기금 및 복권기금 지원으로 공익적 가치 제고에 힘쓰고 있습니다.