Seminar on

Geometric phases and topological notions in classical waves

by

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Abstract

Man-made structures such as photonic crystals and metamaterials can have fairly complex band dispersions in the momentum space. In this talk, we will show that some geometric and topological properties in the momentum space of some carefully design periodic artificial structures can lead to interesting phenomena. In fact, many modern notions and novel phenomena that were usually thought to be quantum phenomena can be realized in such classical wave systems. I will use a few examples to illustrate the ideas.

Geometric phases: We will discuss the geometric phase of classical systems and its consequences, including using the geometric phase of bulk bands to determine the topological character of band gaps and hence the existence of interface states.

Pseudospin in classical physics: Pseudospin plays a central role in determining many novel physical properties of graphene which have pseudospin of ½, such as Klein paradox, Zitterbewegung, and supercollimation of electron beams. Here we show that in certain photonic crystals exhibiting conical dispersions at k = 0, the eigenmodes near the "Dirac-like point" can be described by an effective spin-orbit Hamiltonian with a pseudospin of 1. We will examine the consequences, including the realization of zero refractive index.

Topological concepts in classical waves: We will discuss how to realize photonic "topological insulators", Weyl points, synthetic gauge fields and one-way transport in microwave and sound wave.

Biography

C.T. Chan received his B. Sc. degree from the University of Hong Kong in 1980 and his PhD degree from the University of California at Berkeley in 1985. He is currently a Chair Professor of Physics at HKUST, the Director of Center for Metamaterial Research and the Executive Director of HKUST Institute for Advanced Study. He has been elected a Fellow of the American Physical Society since 1996. He received the Achievement in Asia Award of the Overseas Chinese Physics Association (2000) and Croucher Senior Research Fellowship (2010). He received the Michael Gale Medal for Distinguished Teaching at HKUST (1999) and is a co-recipient of Brillouin Medal for his research in phononic metamaterials (2013). His primary research interest is the theory and simulation of material properties. He is now working on the theory a variety of advanced materials, including photonic crystals, metamaterials and nano-materials.

Date : 10 April 2015 (Friday)
Time : 02:30 pm – 03:30 pm
Venue : Room 15-202, 15/F, meeting room of State Key Laboratory of Millimeter Waves, 15/F, Academic 3, City University of Hong Kong

***** ALL ARE WELCOME *****

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