



2019 NTHU/NCTS Lecture Series

Prof. Kenneth YOUNG

The Chinese University of Hong Kong

The B Mode in CMB Polarization

SEMINAR

10:30-11:45 , May 1st (Wed.)

P512 of NCTS, 5F, 3rd General Building, NTHU

Abstract:

There is intense interest in the B mode in CMB polarization: any primordial signal would be evidence of inflation. The informal talk will consist of two parts.

The first part will be a general introduction to CMB and its polarization, and the cosmological implications.

The second part of the talk is motivated by the need to understand precisely the common statement that the B mode is characterized by being “like a curl”. Specifically, we ask how a linear polarization field (a traceless rank-2 tensor) on a surface can be expressed in terms of scalar functions, thus providing an invariant representation and a separation into two components, one of which is the B mode. The case of a finite planar patch is sufficient to exhibit the key ideas, including the formal analogy with decomposing a vector field into a gradient plus a curl, with the B mode like the latter, but only in a formal sense. Generalization to curved (in particular spherical) surfaces is sketched, and global data are analyzed in terms of harmonic functions; this approach also provides a path to vector and tensor spherical harmonics.



COLLOQUIUM

Optical Tweezers and the Ponderomotive Force

13:30-14:45, May 1st (Wed.)

R019, B1, Physics building of NTHU

Abstract:

The 2018 Nobel Prize in Physics was awarded (50%) to Arthur Ashkin “for the optical tweezers and their application to biological systems”. Optical tweezers rely on the ponderomotive force: a dielectric is attracted to a region of high mean squared electric field. Thus the focus of a laser beam can trap a dielectric. A tiny dielectric bead attached to a biological system (e.g., cell or DNA) allows the system to be manipulated (e.g., moved, stretched, set into oscillations) and studied.

Behind the applications is the theory of the ponderomotive force, wherein several subtleties have been elucidated by our group at CUHK, starting with a work in 1976 (Lai and Young, Phys. Rev. A 14, 2329) on radiation pressure “in satisfactory agreement with the recent experimental result of Ashkin and Dziedzic”.

The application of optical tweezers and the interesting issues relating to the ponderomotive force will be described.