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HIGH ENERGY ACCELERATOR RESEARCH ORGANIZATION
THEORY CENTER

Seminar

CMB spectral distortions as solutions to the Boltzmann equations (in English)

SPEAKER : Dr. Atsuhisa Ota (TITECH)

DATE : March 16th (Thur.) 11:00 ~12:00

PLACE : Kenkyu Honkan 1F Meeting Room 3

We propose to re-interpret the cosmic microwave background spectral distortions as solutions to the Boltzmann equation. This approach makes it possible to solve the second order Boltzmann equation explicitly, with the spectral y distortion and the momentum independent second order temperature perturbation, while generation of μ distortion cannot be explained even at second order in this framework. We also extend our method to higher order Boltzmann equations systematically and find new type spectral distortions, assuming that the collision term is linear in the photon distribution functions, namely, in the Thomson scattering limit. As an example, we concretely construct solutions to the cubic order Boltzmann equation and show that the equations are closed with additional three parameters composed of a cubic order temperature perturbation and two cubic order spectral distortions. The linear Sunyaev-Zel'dovich effect whose momentum dependence is different from the usual y distortion is also discussed in the presence of the next leading order Kompaneets terms, and we show that higher order spectral distortions are also generated as a result of the diffusion process in a framework of higher order Boltzmann equations. The method may be applicable to a wider class of problems and has potential to give a general prescription to non-equilibrium physics.

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