

大学院集中講義

講義名： 「物理学特別講義Ⅰ」(1単位)

授業番号： 首都大理工 M：R219 D：R220

題目： Neutrino oscillation physics at long-baseline experiments

講師： Manojit Ghosh 氏 (首都大・特任助教)

日時・場所：

11月4日(金)	4限、5限	8号館307室
11月11日(金)	4限、5限	8号館309室
11月18日(金)	4限、5限	8号館307室
11月25日(金)	4限、5限	8号館307室

概要：

I will give a series of lectures on neutrino oscillation physics at long-baseline experiments. The lectures will be given in English. Each lecture will include tutorials consisting of both numerical and analytical problem solving. As the lectures will be based on the ongoing developments of the current research, it will be great if the students bring their laptop computers. It will also be helpful for numerical problem solving. The contents of each lecture are given on the following page.

上記の通り開講します。

履修申請は、10月26日(金)までに理工学系教務係窓口へ。

尚、計算機環境等についての連絡が必要なので、履修希望者は事前に安田までメールで連絡して下さい。

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- Lecture 1:

- (a) **Neutrinos and their properties**

- (b) **Neutrino oscillation**

vacuum oscillations and matter effects

- (c) **Derivation of Neutrino oscillation probability**

two flavor vacuum, two flavor matter, 3 flavor one mass scale dominance approximation, 3 flavor small θ_{13} approximation

- (d) **Neutrino oscillation experiments/long-baseline experiments**

production and detection mechanisms, signal and backgrounds, charge current and neutral current events

- (e) **Current status of neutrino oscillation parameters**

- Lecture 2:

- (a) **Parameter degeneracy in neutrino oscillation experiments**

hierarchy- δ_{CP} degeneracy, octant- δ_{CP} degeneracy, generalized hierarchy-octant- δ_{CP} degeneracy

- b) **Tutorials of lecture 1**

intermediate steps of derivations, plotting probability formulas and understanding oscillatory behaviors

- Lecture 3:

- (a) **The method of χ^2 analysis for studying neutrino oscillation physics**

flux, cross section, energy resolution, efficiency, calculating events, marginalization, priors, systematic errors, Gaussian and Poisson distributions

- (b) **Tutorials of lecture 2**

understanding degeneracy by numerical analysis

- Lecture 4:

- (a) **Neutrino oscillation beyond standard three flavor scenario**

non standard interactions and sterile neutrinos

- (b) **Tutorials of lecture 3**

estimating sensitivity of the experiments by χ^2 analysis

Reference: M. Ghosh, "Present Aspects and Future Prospects of Neutrino Mass and Oscillation," arXiv:1603.04514 [hep-ph].