

## 論文内容の要旨

### Study of Non-Standard Neutrino Interactions with Atmospheric Neutrino Data in Super-Kamiokande

(スーパーカミオカンデにおける大気ニュートリノデータを用いた  
非標準ニュートリノ相互作用の研究)

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Observation of atmospheric neutrinos show the clear deficit of upward going  $\nu_\mu$  events. This was called as atmospheric neutrino problem. Our observations have been well explained in the 2-flavor  $\nu_\mu \leftrightarrow \nu_\tau$  oscillation scheme and the  $\Delta m_{23}^2$  and  $\sin^2 2\theta_{23}$  parameters have been measured.

Neutrino oscillations in atmospheric neutrinos play a very important role in particle physics because they present the clear evidence for physics beyond the standard model.

However, a lot of attempts have been proposed to explain the atmospheric neutrino problem without neutrino oscillations generated by neutrino masses and mixing angles. Among many alternative models, one possible solution to the problem is non-standard neutrino interactions where the neutrinos possess non-standard interactions with matter. Non-standard interactions show a good agreement with the low energy atmospheric neutrino events, however the solution with pure non-standard interactions was already ruled out due to the clear inconsistency in the high energy  $\nu_\mu$  events.

Nevertheless, there is a room for non-standard interactions to be included in the origin of the atmospheric neutrino problem as a sub-dominant effect. Hence we studied non-standard neutrino interactions with large number of atmospheric neutrino events in Super-Kamiokande.

In this thesis, the atmospheric neutrino data from the Super-Kamiokande-I (1996-2001) and Super-Kamiokande-II (2003-2005) are summarized and used in the analysis. The analysis has been performed with the two schemes: standard 2-flavor  $\nu_\mu \leftrightarrow \nu_\tau$  oscillation with non-standard neutrino interactions in the  $\nu_\mu - \nu_\tau$  sector, and 2-flavor  $\nu_\mu \leftrightarrow \nu_\tau$  oscillation with non-standard neutrino interactions in the  $\nu_e - \nu_\tau$  sector.

As a result of the studies, no significant signal of non-standard neutrino interactions has been observed and the limits on parameters for the non-standard neutrino interactions have been obtained.