

Joint seminar

Title

”Towards Neutrino Mass Spectroscopy using Atoms/Molecules: Span Project”

Speakers

Motohiko Yoshimura, Okayama University
Noboru Sasao, Okayama University

Date: 10:00 ~ 11:20, June 29

Place: Seminar room of Theoretical Physics Division, IHEP

ABSTRACT

In the first part of seminar presented by M. Yoshimura our new project of neutrino mass spectroscopy using atoms is reviewed from a theoretical point.

This project aims at systematically and experimentally determining remaining important neutrino parameters: determination of the hierarchical pattern of neutrino masses (normal vs inverted), the absolute neutrino mass value (or the smallest mass assuming three flavors), distinction of Majorana neutrino from Dirac neutrino, and determination of CP violating phases including those intrinsic to the Majorana neutrino. When the smallest neutrino mass (assuming three species of neutrinos) is determined with some precision, we can design experiment detecting the relic neutrino of 1.9 K temperature [1], which is important to the theory of early universe. Emphasis is placed on the principle of experimental method.

In the second part of seminar presented by N. Sasao, the current experimental status is reported. One of the key concepts of the project is “macro-coherent amplification principle” which should amplify otherwise small atomic neutrino rate to observable levels. Recently the principle has been tested experimentally with a two-photon process from a vibrationally excited state of para-hydrogen molecules [2]. The result shows that, owing to generated coherence among the molecules (see Fig.1), the observed rate is 10^{15} larger than that of the spontaneous rate, and that the essential part of the principle is proven experimentally. The detail of the experiment together with the future prospects will be presented in the seminar.

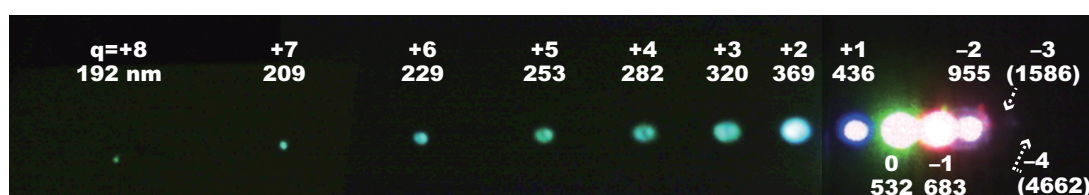


Figure 1: Raman side bands observed in the experiment. Large coherence was generated among hydrogen molecules.

References

- [1] M. Yoshimura, N. Sasao, and M. Tanaka, *Phys. Rev.***D91**, 063516(2015).
- [2] “Observation of coherent two-photon emission from the first vibrationally-excited state of hydrogen molecules”, Y. Miyamoto, H. Hara, S. Kuma, T. Masuda, I. Nakano, C. Ohae, N. Sasao, M. Tanaka, S. Uetake, A. Yoshimi, K. Yoshimura, M. Yoshimura, *Prog. Theor. Exp. Phys.* 2014, 113C01 (arXiv:1406.2198v2)