

Report on my JUSTIPEN trip, 12/09 – 12/23, 2006
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There is a very active research program in Japan on the structure of unstable nuclei. My JUSTIPEN trip to Japan was for collaboration with the Japanese colleagues K. Kaneko (Fukuoka), M. Hasegawa (Fukuoka), and T. Mizusaki (Tokyo) on the shell model study for $N \approx Z$ nuclei, a research topic important also for the rp-process nucleosynthesis.

Kaneko, Hasegawa, and Mizusaki have performed large-scale shell model calculations for $A \sim 60$ nuclei along the $N = Z$ line. These are conventional shell model calculations based on spherical basis. They have tested the model with the extended pairing plus quadrupole interaction, which includes isoscalar and isovector proton-neutron interactions. This shell model has been rather successful in describing nuclear shapes, energy levels, and electromagnetic transitions in $N \approx Z$ nuclei, but cannot be pushed further to the deformed mass-80 region. The projected shell model that I use, which is based on deformed basis, has the advantage in calculating heavier, deformed nuclei. However, the current version of the projected shell model does not respect the isospin invariance. Now for an application of this model to $N \approx Z$ nuclei, the isospin invariance should be taken into account.

During my four-day visit in Fukuoka, I discussed with Kaneko and Hasegawa about adding the missing terms of interaction to the projected shell model Hamiltonian. It turned out that we may be able to discuss interesting aspects if we compare, while employing the same Hamiltonian, the results of both types of shell models that are constructed, respectively, in spherical and in deformed basis. Other topics that we also discussed include the role of the monopole interaction and the study of Gamow-Teller transitions for unstable nuclei. I also met Mizusaki at the Center of Nuclear Studies (CNS) in RIKEN, and discussed calculation details with him for these projects.

I delivered a JUSTIPEN seminar at RIKEN's RIBF Conference Hall, entitled "Projected shell model for heavy nuclei and nuclear astrophysics". The seminar was hosted by T. Otsuka. In the seminar, I presented how one can perform shell model calculation for heavy, deformed nuclei and what shell model calculations may be applied to problems of nucleosynthesis. In a subsequent chat with Otsuka, we talked about possible effect of the tensor force in models that employ effective or phenomenological interactions.

I was also invited to give a seminar at Tsukuba University (Title: "Nuclear shell model for heavy, deformed nuclei", hosted by T. Nakatsukasa) and a seminar at Kyushu University (Title: "Projected shell model for nuclear structure", hosted by Y.R. Shimizu).

I had a long conversation with M. Ishihara, RIKEN's former Chief Scientist of the Nuclear Physics Laboratory and the former head of the CNS. I could feel strongly his eagerness to establish an international collaboration for the RIBF at RIKEN.

Professor A. Arima invited me to visit his downtown office, followed by a pleasant lunch conversation. I was extremely happy to see that in spite of his busy administration duty, he keeps thinking of important physics. The long-debated question of missing Gamow-Teller strength in the high energy region was our main topic of discussion.