Yang Sun, University of Notre Dame

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.

Kanoko, 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.
Ootsuka. 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.