

REPORT ON A VISIT TO RIKEN AND TOHOKU UNIVERSITY 12-2006

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I visited Riken Dec 4–20. Here my main project was to collaborate with Dr Takatoshi Ichikawa in the analysis of fission potential-energy surfaces. At Los Alamos we have already calculated for each of 5254 nuclei the potential energy of fission nuclei for more than 5 million different shapes (5 different shape parameters). During my visit we focused on extracting fission-barrier parameters from the calculated surfaces, that is the height of the first and second peak in the barrier and the height of the fission isomeric minimum. We analyze the energy surfaces by use of a water-immersion method borrowed from the field of geography. I and Ichikawa have independently developed computer implementations of this technique. We prepared figures comparing the calculations to barrier parameters deduced from experiments for 10 isotope sequences ($90 < Z < 99$). A difficulty is that the calculated barriers often have more than two peaks but that experiments have used the assumption of only two peaks in the barrier to extract barrier parameters from experimental cross sections. However, in a few cases experiments have been analyzed in terms of three peaks, that is the outer barrier peak is assumed to be split into two by a shallow “third” minimum. Our calculations often agree well with these assumptions. We put finishing touches on a PRC manuscript that presents these comparisons and that describes our methods in depth. We also discussed the abrupt transition in fission properties at ^{258}Fm and what our calculations tell us about these. For the future we were excited about using the calculated surfaces as a starting point for a realistic treatment of various aspects of fission dynamics, such as mass and kinetic energy distributions. We anticipate continued close collaborations on these issues, and on heavy ion reaction topics where Ichikawa just completed a nice study of deep sub-barrier fusion in the reaction $^{64}\text{Ni}+^{64}\text{Ni}$. Dr Akira Iwamoto (JAEA) visited several times to participate in these discussions.

Professor Sagawa (Aizu University) arranged a mini-symposium at Riken on *Gamma deformation of nuclear systems* where I delivered the introductory presentation. Other speakers were Koizumi (JAEA), Takigawa (Tohoku), Sagawa, Nakatsukasa (Tsukuba), and Koura (JAEA). The attendance was fairly large, perhaps 40 people during my presentation and slightly smaller later.

One afternoon I also visited Tokyo University and discussed fission and other nuclear-structure properties with Professor Otsuka and his doctoral students.

At Tohoku University I met Drs T. Ohtsuki, K. Hagino and N Takigawa. With Dr Ohtsuki I reviewed his experiments on environmental effects on the half-lives of ^7Be , his studies of a low-lying isomer in ^{229}Th , and his ongoing experimental studies of (n,f) reactions in the minor actinides. With Dr Hagino I discussed his studies with Ichikawa and Iwamoto on deep sub-barrier fusion. With Dr Takigawa we continued our discussions started at RIKEN about his relativistic mean-field calculations of potential-energy surfaces for a sequence of Ge isotopes with Nyein Wink Lwin (a student from Mandalay University, Myanmar). Our results in quite different models turned out to be quite similar. However, the relativistic mean-field calculations at this point did not consider nuclei of triaxial shape. I also gave a seminar at Tohoku.

The travel funds associated with this visit were provided through JUSTIPEN. I appreciate very much the opportunity this grant gave me to continue my longstanding collaborations with several Japanese groups.