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（2015 年 1 月改定）

滞在型研究員報告書
Activity Report for the NAOJ Visiting Fellows Program

所　　属 (Institution)	Soongsil University, Seoul, Republic of Korea (South Korea)
氏　　名 (Name)	Eun Ja Ha
研究課題名 (Research subject)	Application of spin-isospin excitations in deformed QRPA to r- and p-process nucleosynthesis and neutrino cooling in massive stars
滞在期間 (Period of stay)	2016 年　2 月　10 日～ 2016 年　2 月　24 日
受入責任者氏名 (NAOJ host researcher)	Prof. T. Kajino

１．滞在型研究員として国立天文台滞在中に行った活動について簡単にお書きください。
(Summarize your activities during the stay using the NAOJ Visiting Fellows Program.)

During my visit I had the opportunity to work with Prof. Toshitaka Kajino, Prof. Isao Tanihata, Prof. Toshio Suzuki, Prof. Wako Aoki and their collaborators on the relevant nuclear structure and reactions and their applications to explosive nucleosynthesis such as r- and p-processes in the stellar evolution of massive stars (supernovae). The spin-isospin excitations induced by weak interaction have been calculating within the deformed QRPA. In particular, Gamow-Teller (GT) transition is a main transition on nucleosynthesis. In addition, my advisor Prof. Cheoun is an NAOJ visiting professor during my stay and was able to work together with us in this project.

During my stay, we made progress in this project in several ways. We made a code for GT transition within deformed QRPA included in neutron-proton pairing correlations. This code is the first numerical approach in the world. Before this visit, we had a sum rule problem on GT transition, which is called as Ikeda Sum Rule (ISR), and it was not satisfied if the np-pairing is included. We solved this problem during my stay with intensive discussions with Prof. Kajino and Prof. Suzuki. Much of experimental informations were provided by Prof. Tanihata. We also applied these results to supernova nucleosynthesis, too.

We applied this code to calculate GT strength for light nuclei like C-O-Ne-Mg isotopes with isospin zero, which are typical N=Z nuclei which are most important for supernova nucleosynthesis alpha-process as well as r- and p-processes on high-entropy conditions. We discussed the result with Prof. Aoki who provide with astronomical observations.

We plan to apply this code, which will be parallelized, to medium and heavy nuclei in the near future. It will be very useful to treat especially nuclear reactions for p-process nuclei.

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２．今回滞在型研究員として得られた成果について簡単にお書きください。
(Summarize your research products from the stay.)

We have written a draft of a paper, entitled “Neutron-proton pairing effects on the Gamow-Teller transitions in 24,26Mg by using the deformed QRPA, and application to supernova nucleosynthesis”, and will be submitted for publication. We also plan to present this results in KPS (Korea Physical Society) meeting , Daejean, in Korea, April 20-22 2016, and NIC (Nuclei in the Cosmos XIV) 2016, Niigata, in Japan, June 19-24 2016.

３．この制度について何か御意見がありましたら、お書きください。
(Please provide any comments about this program.)

I think this visiting fellows program is very fruitful and valuable. This was the first time to visit at NAOJ using this program. The environment for research was very nice and the staffs in NAOJ were also very kind for me. I would like to thank NAOJ for providing me with this valuable opportunity and also deeply appreciate Prof. Kajino for his hospitality and clear discussions in this project. I really enjoyed discussions with several collaborators in his group. Lastly, I would like to visit NAOJ again in the future.