

滞在型研究員報告書

Activity Report for the NAOJ Visiting Fellows Program

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氏 名 (Name)	Grant J. Mathews
研究課題名 (Research subject)	Element Genesis and Particle Cosmology
滞在期間 (Period of stay)	年 月 日 ～ 年 月 日 2016 6 15 2016 7 14
受入責任者氏名 (NAOJ host researcher)	Prof. Toshitaka 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.)

Throughout my stay I mainly concentrated on two projects; First, to study the effects of fission barriers on r-process nucleosynthesis on neutron star mergers as well as supernovae, and second to implementation of micro-turbulence in core collapse supernova explosions, neutrino transport, and r-process nucleosynthesis in the neutrino driven wind.

We first developed a new model for the galactic chemical evolution of r-process elements due to merging neutron star binaries. For the week of June 18-24 I attended the International Conference on Nuclei in the Cosmos in Niigata where I presented an invited talk on the origin of r-process elements. Subsequently, I attended the NAOJ meeting on “Many Riddles about Core Collapse Supernovae” where I presented an invited talk on “neutrino transport and convection in core collapse supernovae.” More practically I concentrated on completing a review paper on “Impact of new data for neutron-rich heavy nuclei on theoretical models for r-process nucleosynthesis.” This paper was co-authored with Toshitaka Kajino and described all aspects of r-process nucleosynthesis models, observations, and measurements. This extensive review was most and submitted to Reports on Progress on Physics during my visit. Our second project of numerical study of supernova explosion is still under way.

I also worked on a novel idea showing that there is a possible presence of previously un-noticed superstring excitations in the cosmic microwave background. This was completed during my stay and will soon be submitted to the Physical Review D. This is collaboration with Toshitaka Kajino and Kiyotomo Ichiki (Nagoya University). I further collaborated with Jun Hidaka and Toshitaka Kajino to complete and submit a paper in the red supergiant problem and the relic neutrino background. This paper was completed and submitted to ApJ during my visit and has subsequently been accepted for publication. Finally, I worked with Toshitaka Kajino and Jun Hidaka to complete a paper on the impact of sterile neutrino dark matter on core collapse supernovae. We studied the 7 keV sterile neutrino that is thought to have produced the

anomalous 3.5 keV line in M31 and the Perseus cluster. This paper was completed during my visit and has now been accepted for publication. These studies are still a part of our global collaborative projects on astrophysics and cosmology, and many extensive studies are still going on.

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 could complete the following papers based on our discussions during my stay.

1. T. Kajino, and G. J. Mathews, Impact of new data for neutron-rich heavy nuclei on theoretical models for r-process nucleosynthesis, Reports on Progress in Physics, (2016) submitted.
2. J. Hidaka, T. Kajino, and G. J. Mathews, Red-supergiant and Supernova Rate Problems: Implication for the Relic Supernova Neutrino Spectrum, Astrophysical J, 827 (2016), 85.
3. M. L. Warren, G. J. Mathews, M.Meixner, J. Hidaka, and T. Kajino, Impact of sterile neutrino dark matter on core-collapse supernovae, Modern Physics Letters A (2016), in press.
4. G. J. Mathews, M. R. Gangopadhyay, K. Ichiki, and T. Kajino, Possible Evidence for Resonant Superstring Excitations during Inflation, Physical Review D (2016), to be submitted.

I also note that we participated in several meetings where I could present our results which we carried out through our discussions with Toshitaka Kajino and many other collaborators before and during this visit.

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.)

This NAOJ Visiting Fellows Program is indeed a fantastic program to be productive and pleasant scientific exchange for all visitors including me. It is always my joy to visit and stay at NAOJ for promoting collaborations in several on-going and new projects as listed above. The opportunity to participate in this program has ever accelerated our collaboration and productivity by many months with Toshitaka Kajino and his group members. This is a valuable program to promote healthy research collaboration which has produced a large volume of research over the past twenty years and should continue to do so.