

滞在型研究員報告書

Activity Report for the NAOJ Visiting Fellows Program

所 属 (Institution)	Department of Physics, Western Michigan University, Kalamazoo, MI 49008 USA
氏 名 (Name)	Michael Famiano
研究課題名 (Research subject)	Explosive Nucleosynthesis and Galactic Chemical Evolution
滞在期間 (Period of stay)	2016 年 6 月 18 日 ~ 2016 年 7 月 15 日 YYYY MM DD YYYY MM DD
受入責任者氏名 (NAOJ host researcher)	Professor 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.)

Several following science topics and activities were pursued during my stay at NAOJ Mitaka:

Science topics and discussions, including:

- 1) Sensitivity studies of Type Ia supernovae to nuclear structure calculations. We have completed work to study how changes in the nuclear shell structure of pf-shell nuclei affect nucleosynthesis in the the explosions of white dwarf stars. Interestingly, we found that ^{54}Cr is an important species in quantifying the nucleosynthesis in the core. We hope to continue this work in the future by examining either multi-dimensional models or at least looking at fluctuations in the temperature-density profiles of type Ia supernovae.
- 2) Studies of the sensitivity of galactic chemical evolution abundances to the nuclear equation of state. We have completed an initial work to quantify the spread in abundance ratios of r-process elements in metal-poor stars as a function of the nuclear EOS. This is particularly interesting result, because this may represent the first proposed observation which places a minimum value on the stiffness of the nuclear EOS
- 3) Improvement of nuclear screening calculations in hot and/or dense astrophysical environments. In a prior visit, we examined the effects of relativistic electron screening on big bang nucleosynthesis. We are working on expanding our screening calculations from the regime of a relativistic plasma to a quantum plasma – that is, a low density, high temperature plasma. This is very important in the ignition and explosion of white dwarfs.

Meetings, including topical discussions, including:

- 4) Invited and oral talks and discussions at Nuclei in the Cosmos XIV, The NAOJ ECT* Workshop, and Seminar at RESCEU, The University of Tokyo.
- 5) Informal discussion meetings with graduate students and post docs at Prof. Kajino's group at The Theoretical Astronomy Division of NAOJ Mitaka.

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.)

The following publications were either completed or submitted:

- 1) *Dependence of the Sr-to-Ba and Sr-to-Eu Ratio on the Nuclear Equation of State in Metal Poor Halo Stars*, M.A. Famiano, T. Kajino, W. Aoki, & T. Suda, ApJ (2016), in press.
- 2) *Impact of New GT Strengths on Explosive SNIA Nucleosynthesis*, K. Mori, M. Famiano, T. Kajino, T. Suzuki, J. Hidaka, M. Honma, K. Iwamoto, K. Nomoto, T. Otsuka, ApJ (2016), submitted.

During this stay, the following talks were given:

- 3) *Nuclear Equation of State Constraints From r-Process Abundance Ratios*, Nuclei in the Cosmos XIV, Niigata, Japan, June 20-24, 2016.
- 4) *Dependence of Elemental Abundance Ratios in Metal-Poor Stars on the Nuclear Equation of State*, 2nd NAOJ-ECT* Workshop: Many Riddles About Core-Collapse Supernovae: 1 Bethe and Beyond, June 27 - July 1, 2016.
- 5) *Equation of State Inputs to the r-Process and Galactic Chemical Evolution Effects*, RESCEU, The University of Tokyo, July 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.)

Prof. Kajino's Cosmology and Astronomy group at the NAOJ is very likely the most productive group in this field of the world. The Visiting Fellows program provides a tremendous opportunity for scientists around the world to come together in one place to solve challenging problems. The resources provided by the Theoretical Astronomy Division and SUBARU Observatory including TMT group at NAOJ Mitaka in the form of time, students, expertise, and computing alone are invaluable. In combination, they are priceless. I would highly recommend not only continuing this program, but enhancing it if possible. Over the past several years, this program has made valuable contributions to the discipline in the form of knowledge, training, and discovery in astrophysics and cosmology.