滞在型研究員報告書（様式２）　　（2008 年 9 月策定）

国立天文台滞在型研究員の方には期間中の成果について報告をしていただくことになっております。このフォームに記していただき期間終了 2 週間以内に国立天文台研究支援係にご提出ください。なおこの報告書は研究成果の論文掲載前でも研究交流委員会の web 上に公開いたしますので、研究内容の詳細について記入していただく必要はありません。この研究の成果を学術誌等で発表するときはその旨を謝辞に記載してください。

2013 年 12 月 12 日

所属　Max Planck Institute for extraterrestrial Physics
氏名　Prof. Roland Diehl
受け入れ　　氏名：　Prof. T. Kajino
滞在期間　　2013 年 10 月 30 日　～　2013 年 11 月 21 日

I．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。（Your activity during this stay）：

My activities during this trip involved mainly student teaching and interactions with students, and discussions with Prof. Toshitaka Kajino and his colleagues at NAOJ and University of Tokyo, moreover attendance at a conference and a winter school. I shared and presented the methods and results of observational high-energy astrophysics, and we discussed aspects of nuclear astrophysics of common interest. In more detail, this involved:

a. Discussions of our complementing approaches to learn about the physical processes that underlie and determine the explosions of supernovae from massive star collapses, and star formation and supernova rates in different locations and at different times throughout the universe.
b. Discussions of the methods to observe radioactive isotopes upon their decay, and the extent we have been able to learn from them.
c. Presentation of our (myself, together with the teams working in the ESA mission INTEGRAL and its data analysis and interpretation) work and results from measuring characteristic gamma-ray lines from cosmic sources, and how we learn from these about massive stars and supernovae, and pair plasma sources including dark matter decays. This was done via a colloquium at the Department of Astronomy, University of Tokyo. Our work in this area has produced a new view of Galactic star formation in and near spiral arms and the fate of their ejecta, which also shows ejecta mixing from massive-star supernovae to occur rather delayed and distributed, which may imply

r-process interpretations to need some caution attributing it to specific individual sources. Then, our results on positron annihilation in our Galaxy were demonstrated to present a major puzzle, in that neither of the candidate sources is compatible with those spectral and morphological results. We enjoyed lively discussions on further theories of its origins, and on how to confront those with observational detail.

d. Presentation of our above work at the Origins of Matter and Evolution of Galaxies (OMEG) conference, with lively interaction with a number of conference participants. Astrophysics, including an Introduction into the broader high-energy astrophysics field, a basic course on instrumentation for X-ray and gamma-ray telescopes and spectrometers, and on nuclear astrophysics, plus three courses on specific source types of supernovae and novae, accreting binaries and nuclear processes on compact stars, and on diffusion and mixing of nucleosynthesis products and chemical evolution of galaxies.

f. Presentation of a Lecture as part of the Asian Winter School 2013, including latest results from the INTEGRAL space observatory on nuclear lines and positron annihilation in our Galaxy. Individual student discussions and career advice followed from this, and also stimulating interactions with other lecturers, such asProf. Wako Aoki, Prof. Raffaele Flaminio, Dr. Tomoya Takiwaki, Prof. GrantMatthews, and of course Prof. Toshitaka Kajino.

II. 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。（Your research products from this stay）：

1. This has been my first experience teaching to students in Japan. It has been a great experience overall, and I learned to appreciate the differences to students in Europe, Americas, and China, but also learned to appreciate different approaches of students in a variety of Asian countries. I was amazed by the curiosity and questions asked by many students, and by their level of education which allowed discussions at a high level of sophistication.
2. My discussions with Prof. Toshitaka Kajino and his colleagues at NAOJ were enlightening, as we have very different approaches to the same astrophysical issues. This exposed new ideas and connections between the two of us, which our meetings aside conferences in the past could not reveal, I found this stimulating my ideas about interpretations in core collapse supernovae and the role neutrinos play during the collapse, for onset of the explosion, and during nucleosynthesis, as I emphasize the observational insights and the open issues currently filled in through different hypotheses which are not easy to distinguish.

3. The experience of living in the environment of professional astrophysics research at NAOJ was rich also in learning about infrastructure and work arrangement, and led to stimulating discussions about science-political and strategic issues in nuclear and high-energy astrophysics, finding commonalities among countries but also appreciating different opportunities in different environments.
4. The OMEG conference was arranged with an exquisite selection of invited speakers throughout the world, which I applaud organizers for. This conference has been evolving into a highlight among conferences, being the right size for in-depth discussions at a very high level, most participants striving for deeper understanding of the astrophysical objects and processes much more than promoting their own field or approach (as it often dominates at other conferences).

III. この制度についてなにか御意見がありましたら、なんでも記入ください。
(Any opinions on this exchange program) :
I applaud the NAOJ for supporting such an excellent exchange program. I sincerely believe that this provides substantial enrichment for both parties, and is an excellent pillar of supporting science, beyond institutional and specific-project funding. Shaping a community of scientists who can communicate well and stimulate each other is a necessity, and this program is a very effective complement to conferences on one end and sabbaticals or other long-term visits on the other end.