Activity Report of the NAOJ Visiting Scholar Program

Host Project/Division: 太陽系外惑星探査プロジェクト室 Name of Host Scientist: Prof. Motohide Tamura Name of Visiting Scholar: Devendra Kumar Ojha Title: Visiting Professor (Choose the appropriate one) Period: from YY/MM/DD to YY/MM/DD 2014/06/08 to 2014/07/09

I. Report from the visiting scholar

[i] Achievement during the period of stay (in comparison with the initial plan)

(Collaborative Research)

The purpose of my visit to NAOJ was to continue our long-term collaborative programs with Prof. Motohide Tamura on high-mass Galactic star-forming regions. During my NAOJ visit, we also extended our work to several southern star-forming regions. We first presented deep and high-resolution (FWHM ~ 0.4 arcsec) near-infrared (NIR) imaging observations of the NGC 7538 IRS 1-3 region (in JHK bands), and IRS 9 region (in HK bands) using the 8.2 m SUBARU telescope. We found that the YSO mass function (MF), constructed using a theoretical mass-luminosity relation, shows peaks at substellar (~0.08-0.18 M☉) and intermediate (~1-1.78 M☉) mass ranges for the IRS 1-3 region. An upper limit of 10.2 is obtained for the star to brown dwarf ratio in the IRS 1-3 region. Our research findings indicate that a relative number of brown dwarfs may differ among regions in the Galaxy. We further carried out investigations of the southern Galactic high-mass star-forming regions, G351.63-1.25 and IRAS 16148-5011, using multiwavelength data in NIR from the 1.4 m IRSF telescope and low-frequency radio continuum observational results in these star-forming regions. We therefore successfully extended our multiwavelength study (Optical, NIR and radio) in southern star-forming regions. (Education)

I also presented 3 seminars at various places during my visit to Japan and interacted with the graduate students as well as postdocs. I also discussed the possibility of collaborative work with few postdocs at NAOJ and University of Tokyo using the TIFR Near Infrared Spectrometer & Imager (TIRSPEC; 1 - 2.5 microns) which has recently been commissioned at the 2 meter Himalayan Chandra Telescope (HCT) at Hanle (Ladakh), India. It is planned that an observing proposal will be submitted in the next HCT cycle based on our discussions.

(Others)

Based on the results obtained with IRSF and SUBARU, we also initiated follow-up deep infrared polarimetric observations of a few high-mass star-forming regions with the SIRPOL camera attached to the 1.4 m IRSF telescope in South Africa. We also continued the follow-up observations in Optical, NIR and radio wavebands with Indian facilities.

[ii] Any comments on this program

Japan is currently a world leader in the field of ground- and space-based astronomy, particularly Infrared Astronomy. This has been demonstrated by its past and present ground-based (e.g. IRSF, SUBARU, etc.) and space-borne missions (e.g. IRTS, AKARI, etc.), which have been extremely successful. In addition, plans in the near future (e.g. SPICA) are also very ambitious. In my opinion, this success is based on the following: a very strong commercially available engineering / technology base in Japan; extremely hardworking scientists, and engineers (probably the most hardworking in the world); and the ability to attract a large number of young graduate students into their science experiments. As an Indian scientist, I feel fortunate to get an opportunity to participate in various collaborative programs through the NAOJ Visiting Scholar Program. I can state that the support from this program for my present visit has been excellent and very satisfactory.

[iii] List of publications and presentations by the visiting scholar in collaboration with NAOJ staff or graduate students

The following research papers published / submitted/prepared during my stay in Japan:

Publications:

- NGC 7538: multiwavelength study of stellar cluster regions associated with IRS 1–3 and IRS 9 sources. K. K. Mallick, D. K. Ojha, M. Tamura, A. K. Pandey, S. Dib, S. K. Ghosh, K. Sunada, I. Zinchenko, L. Pirogov and M. Tsujimoto, MNRAS 443, 3218–3237 (2014).
- Star formation activity in the southern Galactic H II region G351.63-1.25. S. Vig, S. K. Ghosh, D. K. Ojha, R. P. Verma and M. Tamura., MNRAS 440, 3078–3090 (2014).
- Star formation in the filament of S254-S258 OB complex: a cluster in the process of making. M R. Samal, D. K. Ojha, J. Jose, Satoko Takahasi, A. K. Pandey, N Chauhan, I. Zinchenko, J. S. Kim, M. Tamura and S. K. Ghosh, Astron. & Astrophys (Under Revision, September 2014).
- IRAS 16148-5011: A high-mass star-forming cluster in the southern sky. K. K. Mallick, D.K. Ojha, M. Tamura, H. Linz, M. R. Samal and S. K. Ghosh, MNRAS (to be submitted during September 2014).

I also delivered the following talks at various places in Japan during my stay:

Presentations:

- 26-June-2014: Invited talk presented at Nishi-Harima Astronomical Observatory (NHAO) at Sayo (Hyogo).
 Title: The outburst and nature of young eruptive low mass stars in dark clouds
- 30-June-2014: Invited talk presented at Institute of Space and Astronautical Science (ISAS-JAXA), Sagamihara. Title: The Episodic Accretion in Young Low Mass Stars
- 01-July-2014: Invited talk presented at Department of Astronomy, University of Tokyo, Hongo Campus.
 Title: Understanding the outbursts in young low mass stars

Ⅱ. 以下の項目について、受入教員が記入してください。

Report from the host scientist

[iv]本制度に対する意見、要望など

Any comments on this program

本滞在を通じて 4 本の査読論文を改訂あるいは投稿することができた。非常に有効な制度なので、今後 もぜひ継続してほしい。