Session:	**[B3A-2] S2 : Interstellar Matter, Star Formation and the Milky Way**
Date:	August 20, 2014 (Wednesday)
Time:	11:00~12:30
Room:	Room B (Room 103)
Chair:	Toshihiro Handa (Kagoshima University)

[B3A-2-1] **11:00~11:20**

[Invited] Near-Infrared Study of Young Galactic Supernova Remnants

Bon-Chul Koo (Seoul National University, Korea)

Young Galactic supernova remnants (SNRs) are where we can observe closely the supernova (SN) ejecta and its interaction with circumstellar/interstellar medium. Therefore, they provide an opportunity to explore the explosion and the final stage of the evolution of massive stars. Near-infrared (NIR) emission lines in SNRs mostly originate from shocked dense material. In shocked SN ejecta, forbidden lines from heavy ions are prominent, while in shocked CSM/ISM, [Fe II] and H2 lines are prominent. [Fe II] lines are strong in both shocked SN ejecta and shocked CSM/ISM, and therefore [Fe II] line images provide a good starting point for the NIR study of SNRs. The number of Galactic SNRs observed in [Fe II] emission lines has increased substantially recently by UKIRT Widefield Infrared Survey for Fe+ (UWIFE), which is an unbiased survey of the Galactic Plane ($10^{o}<\ell<65^{o}$; $|b| \le 1^{o}.5$) in [Fe II] 1.644 um line using the UKIRT 4-m telescope. There are now about twenty SNRs detected in [Fe II] lines, some of which have been studied by NIR spectroscopy. In this talk, I will review the NIR observations of SNRs and present recent results on young Galactic core-collapse SNRs.

[B3A-2-2] **11:20~11:40**

Supernova Remnants in the Magellanic Clouds

Miroslav D. Filipovic (University of Western Sydney, Australia) and Luke Bozzetto

This is an exciting time for the discovery of supernova remnants (SNRs) in galaxies other than our Milky Way. To date, some 85 SNRs in the MCs are well established with other 20 waiting for confirmation. I will review recent searches for SNRs in the Magellanic Clouds including our present state of knowledge of their comparative properties.

[B3A-2-3] **11:40~12:00**

[Invited] Constraints on Supernova Progenitors from Integral Field Spectroscopy of the Explosion Site

H. Kuncarayakti (Universidad de Chile, Chile), G. Aldering, J. P. Anderson, N. Arimoto, M. Doi, L. Galbany, M. Hamuy, Y. Hashiba, K. Maeda, T. Morokuma, and T. Usuda

Despite the large number of observed events, the progenitors of supernovae (SNe) are still not very clearly understood. There have been extensive efforts on both theoretical and observational grounds to constrain the physical properties and evolutionary status of the SN progenitors. A handful of SN progenitors have been directly detected in pre-explosion archival Hubble Space Telescope images, but these detections are very rare and most SNe do not have pre-explosion data available. More observational evidences on SN progenitors are needed to be compared with the theoretical predictions. In this work we attempt to constrain the core-collapse SN progenitor properties based on the study of the SN immediate environment.
With this strategy we expect to build a statistical sample without relying on the availability of preexplosion data. The stellar populations present at the SN explosion sites are studied by means of integral field spectroscopy, which enables the acquisition of both spatial and spectral information of the object

simultaneously. The spectrum of the SN parent stellar population gives the estimate of its age and metallicity. With this information, the initial mass and metallicity of the once coeval SN progenitor could be derived. As mass and metallicity are the two most important parameters in stellar evolution, this gives strong constraints on the progenitor stars of each of the SN subclasses. From our initial dataset we have found that SNe Ic are the most massive and metal-rich compared to the other subtypes, and there are indications that binary progenitors are prevalent in producing stripped SNe. While the survey is mostly done in optical, additionally the utilization of near-infrared integral field spectroscopy assisted by adaptive optics enables us to examine the explosion sites in high details. This work is carried out using multiple telescopes equipped with integral field spectrographs in Chile and Hawaii, including VLT and Gemini.

[B3A-2-4] **12:00~12:15**

IR-to-X-ray Ratio of Supernova Remnants in the Large Magellanic Cloud

Ji Yeon Seok (Academia Sinica Institute of Astronomy and Astrophysics, Taiwan), Bon-Chul Koo, and Hiroyuki Hirashita

Infrared-to-X-ray flux ratio (IRX) traces the relative importance of dust cooling to gas cooling in astrophysical plasma. Dust grains are predicted to be a dominant coolant in the lifetime of a supernova remnant (SNR). We derive IRXs of SNRs in the Large Magellanic Cloud (LMC) using Spitzer and Chandra SNR survey data. We find that the IRXs of all the SNRs in our sample are moderately greater than unity, indicating that dust is more efficient coolant than gas although gas cooling is not negligible. Comparison to IRXs of Galactic SNRs shows that the IRXs of the LMC SNRs are systematically lower than those of the Galactic SNRs. As both dust cooling and gas cooling are pertaining to properties of the interstellar medium, the lower IRXs of the LMC SNRs may reflect the characteristics of the LMC, and the lower dust-to-gas ratio of the LMC (one-forth of the Galactic value) is likely to be the most significant. The observed IRXs are compared to theoretical predictions, which prove to overproduce the observed IRXs by an order of magnitude. This may originate from the dearth of dust in the remnants either due to severe dust destruction via sputtering or due to the local variation of the dust abundance in the preshock medium as compared to the global dust abundance. Finally, we discuss implications for the dominant cooling mechanism in low metallicity galaxies.

[B3A-2-5] **12:15~12:30**

Star Formation in Extreme Galactic Environments

Quang Nguyen Luong (Canadian Institute for Theoretical Astrophysics, Canada), Frederique Motte, Fabian Louvet, and Tracey Hill

Recently, observations of star formation has been revolutionized by the availability of observation platforms across the infrared to mm wavelengths. It has enabled us characterizing the star formation activities from the scales of individual protostars (0.1 pc) in the Galactic environments to the scales of molecular cloud complexes (100 pc MCCs) at distant extragalactic environments. MCCs are on one hand the building blocks of star-forming galaxies and on the other hands are the hosting sites of massive star formation.
By combining large scales dust continuum surveys mainly from Herschel, Spitzer with molecular line surveys from ground-based telescopes, we have resolved the structures, physical properties and star formation activities of the MCC in the Galaxy down to a great spatial and spectral resolutions. We are able now to investigate the dependency of star formation rates of MCCs on its mass and and density. It turns out that star formation in the Galaxy are occurring mostly occurring in a few MCCs which are located at some extreme dynamical environments such as Bar-Arm junctions and other highly dynamical regions. There are a few clues that the strong dynamics of these places are responsible for the starbursts events in the Galaxy which make us term them as ministarburst. The ministarbursts turn out to be dominant structures of high-z starbursts. We suggest that the differences in star formation rates between starburst vs normal galaxies or between ministarburst vs normal molecular cloud complexes are created by two different modes of star formation.