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Weak Supernovae Induced by the Gravitational Energy Loss in the Black Hole Formation

ブラックホール形成時の重力エネルギー損失による弱い超新星爆発

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Abstract

Simulations are presented for weak explosions induced by the reduction of gravitational core mass due to neutrino emissions as well as current observation of failed supernova candidates

During a massive stellar core collapses into a black hole, an explosion that is much weaker than a normal core collapse supernova is taken place due to the mass reduction effects.

While the shock passing through the hydrogen envelope, energy of the shock transferred onto optical observable by hydrogen recombination. The properties of the shock and the mass, radius determine the brightness and duration of the light curves of the explosion.

Several progenitor models with different masses are tested as well as different values of reduced gravitational mass. The formation of the shock and the radiation transfer are perfumed with FLASH and SNEC. The results show that massive progenitor tends to result in more powerful explosions but the outburst durations are shorter and vice versa. Larger explosion energy gives a brighter but shorter duration light curve. The mass and the radius of the outer hydrogen envelope also change the light curve. These results will be valuable when we constrain the properties of observed failed supernova.

A Study of the Near-infrared Spectroscopic Survey of the Large Magellanic Cloud
Based on Observations with AKARI
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Abstract

Since the Large Magellanic Cloud (LMC) is one of the nearest star-forming galaxies (d ~ 50 kpc), we are able to observe individual stars in it. Based on the Large-area Survey of the LMC with the Infrared Camera on board AKARI in Phase 1&2, a point source catalog and a near-infrared spectroscopic catalog have been released to the public. Slitless spectroscopy of AKARI/IRC provides an efficient tool to make spectroscopic survey in the near-infrared; however, it suffers contamination from overlapping of nearby sources. Compared with Phase 1&2, the observation schedule was specially arranged so that the spectral dispersion direction was rotated by 180° respected to the detector array in Phase 3, resulting in different overlapping parts of spectra. By careful analyses, more spectral information has been derived which could not be obtained only by Phase 1&2 data.

We have performed the data reduction of the AKARI Phase 3 prism slitless spectroscopy (2 - 5.5 μm) of the LMC, which covers almost the same area as in Phase 1&2 (~10 deg^2). A new spectroscopic catalog that includes ~200 (more than 100 new) contamination free and ~900 (more than 500 new) not heavily contaminated sources has been created. A supplementary catalog is also provided.

The time intervals between the Phase 1&2 observations and the corresponding Phase 3 ones are more than 360 days, which allow us to investigate the near-infrared spectroscopic variabilities of sources in the LMC for the first time. In the near-infrared range, YSOs have the absorption features of H_2O ice (3.05 μm), CO_2 ice (4.27 μm) and CO ice (4.67 μm), and carbon stars have those of HCN + C_2H_2 (3.1 μm), C_2H_2 (3.8 μm) and CO (4.6 μm). By making the comparison between the photometric data and spectroscopic data of several YSOs obtained at different epochs, we find that there are variations of continua and absorption features in the near-infrared range. After comparing the I band fluxes, the near-infrared fluxes and the absorption strengths of HCN + C_2H_2, C_2H_2 and CO of several carbon stars, we find that the variability trend of the I band flux is almost the same as that of the near-infrared flux. We also find that while there is no obvious relation between the variability trend of the near-infrared flux and that of HCN + C_2H_2 absorption strength, CO absorption strength varies in a similar way to that of HCN + C_2H_2. Higher resolution spectra obtained in observations that are carried out at many different epochs are needed to make more systematic analyses.