29.12

An Infra-Red Supernova Search in Nearby IRAS Galaxies

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Our poster describes a new search for supernovae (SNe) in nearby galaxies in the near IR bands. This search is designed to measure SN rates more accurately than by optical searches, and to identify SNe near peak brightness within about 10 Mpc, close enough to study with the OSSE instrument aboard the GRO satellite. The search is conducted in the near IR bands in order to find those SNe which are being missed by optical searches due to dust obscuration.

The Berkeley Infra-Red Supernova Search consists of a monthly "patrol" of 166 northern high-latitude galaxies from the IRAS "Bright" sample (Soifer et al. 1987) within our SN detection range, about 25 Mpc. Approximately 45 of these galaxies are within the 10 Mpc range of OSSE. The nearby IRAS bright galaxies are believed to have dusty starburst regions, the expected environment for SNe. Because the extinction coefficient (in mag.) in K band is about one tenth of that in B band, we can search for SNe in these environments, even though they are often hidden from optical searches by extinction. We therefore predict a higher probability of SN detection per observation as well as a more accurate measurement of the overall SN rate compared to optical searches.

The search is currently being conducted at the Wyoming IR Observatory (WIRO) on Mt. Jelm, near Laramie, Wyoming, using HgCdTe IR array detectors.

We gratefully acknowledge financial support from NASA and Lawrence Berkeley Laboratory, and technical assistance from the staff and students of WIRO.

29.13

Theoretical Models of Type II Supernovae and Comparison with Observations

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We present theoretical models of several well observed type II supernovae. The progenitors of the supernovae were evolved with a Henyey-type code, and one dimensional hydrodynamical calculations are carried out to follow the supernova explosions. The light curves and the evolutions of the photospheric radii of the plateau type II supernovae 1969L and 1990E can be well fitted with the explosions of massive progenitors ($15 - 20M_{\odot}$), with little or no mass loss and explosion energies of $\sim 10^{51}$ ergs. On the other hand, the light curves of linear type II supernovae 1979C and 1980K can be fitted with the explosions of progenitors which suffered severe mass loss (with residual hydrogen envelopes of $\sim 2-5M_{\odot}$) and higher explosion energies ($\sim 1-2\times10^{51}$ ergs). Comparisons with previous theories are also discussed.

29.14

The r-Process and Neutrino-Powered Winds

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During iron core collapse and subsequent neutron star formation in massive stars, $\sim$ 10% of the binding energy of the neutron star is released during a Kelvin-Helmholtz time scale in the form of neutrinos whose energy is depositied within an atmosphere in near hydrostatic equilibrium, giving rise to a "neutrino-driven wind". This wind is powered by neutrino/antineutrino capture on nucleons which, due to to hardening of the antineutrino spectrum at late times, causes the material to become neutron-rich. Additionally, due to the short pressure scale height, the region will have a high entropy ($30 \leq S/N_Ak \leq 450$). These conditions conspire to form a region that is especially well suited to the production of the r-process. We present calculations that study the detailed nucleosynthesis that occurs within the last 0.02 $M_{\odot}$ of material ejected in the delayed explosion of a 20 $M_{\odot}$ Type II supernova model. The thermal and compositional evolution of a large number of sample trajectories (40 choices of $\rho(t), T(t), Y_e(t)$) that decrease smoothly and logarithmically down to 10^{-6} $M_{\odot}$ are followed for times as late as 15 seconds after core collapse. We find that a large number of isotopes from mass A$\sim$ 60 to 200 are produced in quantities of interest to galactic chemical evolution.

Unfortunately, the model does not give a satsifactory r-process. The two basic problems are too much material having entropy $\sim$ 40 and $Y_e \leq 0.47$ which comprises much of the ejecta at times in the evolution of the wind before the conditions for the r-process are acheived. These conditions consipre to overproduce nuclei in the $N = 50$ closed neutron shell to such a degree that the star is incapable of producing even oxygen. Additionally, the entropy at late times needs to be $\approx 50\%$ larger to produce the heaviest r-process isotopes. In an acceptable model the entropy would be lower at early times when the mass loss rate is large and higher at late times when the mass loss rate is small. Reasons for why this might actually occur in nature are discussed. Despite the current difficulties found in this particular model, neutrino powered winds from nacent neutron stars remain very attractive sites for the $r-$process.

29.15

BVRI Synthetic Aperature Photometry of Supernova 1993J

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We have been monitoring supernova 1993J in the BVRI Johnson-Morgan filters since March 30 using a 16 inch cassegrain telescope with a Star I CCD and the technique of synthetic aperture photometry. With this technique we were among the first groups to suggest 1993J was dimming by 0.2 magnitudes per day, on following the first of April. While we are currently doing relative photometry with stars within the same CCD frame, we plan to use the adjacent field stars and the field stars in NGC2403 for absolute photometry. The addition of these field stars should help better define our color curve. Within the limitations of our telescope, CCD camera, sky conditions of downtown Austin, and the supernova itself, we hope to follow 1993J for as long as possible.

29.16

CCD Observations of SN1993J in M81 from the Keck Northeast Astronomy Consortium

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We present UBVRI photometry for SN 1993J, as well as data on its likely progenitor. The post-explosion data were obtained with CCDs attached to telescopes (0.4 to 0.6m) on the campuses of the Keck Northeast Astronomy Consortium (KNAC) and on the Burrell Schmidt telescope of the Warner and Swasey Observatory, Case Western Reserve University, at KPNO by the authors and their undergraduate students. We have obtained a fairly well-sampled light curve of the early stages in the outburst, including the rapid decay (0.30 magnitude per day at V) from the initial maximum and the subsequent slower rise to the secondary maximum.

The position of the supernova, as measured on our images agrees to within 0.1 arc-sec with the position of a faint, apparently stellar image, taken with the 0.9m telescope at KPNO on 1992 October 2. The brightness of this object (Perelmuter, IAUC 5736; Filippenko, IAUC 5737; Humphreys *et al.*, IAUC 5739) are consistent with its being a late-type supergiant. A series of images of M81 taken in 1992 November and 1993 February are analyzed to provide