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Atomic Data and the Modeling of Supernova Spectra[1]

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The modeling of supernovae (SNe) incorporates a variety of disciplines, including hydrodynamics, radiation transport, nuclear physics and atomic physics. These efforts require numerical simulation of the final stages of a star's life, the supernova explosion phase, and the radiation that is subsequently emitted by the supernova remnant, which can occur over a time span of tens of thousands of years. While there are several different types of SNe, they all emit radiation in some form. The measurement and interpretation of these spectra provide important information about the structure of the exploding star and the supernova engine. In this talk, the role of atomic data is highlighted as it pertains to the modeling of supernova spectra. Recent applications [1,2] involve the Los Alamos OPLIB opacity database, which has been used to provide atomic opacities for modeling supernova plasmas under local thermodynamic equilibrium (LTE) conditions. Ongoing work includes the application of atomic data generated by the Los Alamos suite of atomic physics codes under more complicated, non-LTE conditions [3]. As a specific, recent example, a portion of the x-ray spectrum produced by Tycho's supernova remnant (SN 1572) will be discussed [4].

[1] C.L. Fryer *et al.*, Astrophys. J. **707**, 193 (2009).
[2] C.L. Fryer *et al.*, Astrophys. J. **725**, 296 (2009).
[3] C.J. Fontes *et al.*, Conference Proceedings for ICPEAC XXVII (Belfast, Northern Ireland), in press, (2011).
[4] K.A. Eriksen *et al.*, Presentation at the 2012 AAS Meeting (Austin, TX).

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