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Supernovae: Progress and Nightmares

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Considerable progress has been made towards modeling supernova (SN) spectra using a variety of codes and techniques. The codes broadly fall into three categories - hydro codes that treat the hydrodynamics but approximate the radiative transfer and the properties of the gas; transfer codes that treat the radiative transfer and gas properties (e.g., temperature, ionization structure) accurately but make simplifying assumptions about the hydrodynamics; and Monte Carlo codes that have varying degrees of accuracy in the treatment of the radiative transfer and the gas properties. Major improvements are required in several areas. The most difficult of these is the consistent treatment of hydrodynamics, radiation transfer and non-LTE state of the gas (in 1D and 3D). At a simpler level more work is needed on time-dependent non-LTE radiative transfer in both 1D and 3D. Density inhomogeneities and abundance inhomogeneities are both important, and their effects can only be approximated in 1D. At nebular times, molecules become important and need to be included. The accuracy of model calculations is also influenced by the availability and accuracy of atomic data.

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