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Understanding the Stellar Fossil Record

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The elements in the Universe have a variety of nucleosynthetic origins—that is, they form in different stars, at different times, and in different physical conditions. The detailed chemical composition of stellar atmospheres can be determined from high resolution spectroscopy. These abundances can further be examined as a function of a star's age and location, providing insight into the formation of galaxies. In this talk I will review how spectroscopic observations of stars in the Milky Way have led to an understanding of its assembly history, and how chemical evolution models have been successful at reproducing the measured abundances. I will also discuss techniques for understanding galaxy formation and chemical evolution beyond the Milky Way, including high-resolution integrated light spectroscopy of distant globular clusters. Finally, I will highlight the importance of the elements that form via the rapid (r-) neutron capture process, and recent efforts to identify new r-process-enhanced stars in the Milky Way halo.