Title: Metal-Poor Stars in the Milky Way

HK and Hamburg ESO (HES) surveys identified numerous very metal-poor (VMP; [Fe/H] < -2.0) stars in the Galactic halo. In recent years, this number has been dramatically increased to many tens of thousands of VMP stars by various spectroscopy surveys such as SDSS, SEGUE, and RAVE. Detailed chemical-abundance analyses, based on high-resolution spectroscopic follow-up, have revealed that, while most VMP stars exhibit similar abundance patterns, there are numerous examples of objects with peculiar chemical patterns. Among the chemically peculiar stars, objects with enhancement of carbon abundance are the most common variety. These are now called carbon-enhanced metal-poor (CEMP) stars. One of interesting aspects of the CEMP stars is that according to the level of enhancement of neutron-capture elements (e.g., Ba and Eu), they are divided into several groups, namely, CEMP-s, CEMP-no, CEMP-r, and CEMP-r/s. It is believed that the nucleosynthetic products from the first-generation massive stars are imprinted in the CEMP-no stars. The CEMP-no stars are also discovered in ultra-faint dwarf (UFD) galaxies around the Milky Way, and their abundance pattern is very similar to that of the Galactic halo stars at a given metallicity, suggesting that some portion of the halo objects may be accreted from disrupted dwarf galaxies.

In this lecture, I will review the current understanding of the origin of CEMP stars and discuss their implications to the first-generation stars and the formation of the Galactic halo. Especially, I will focus on talking about the discovery of signatures of nucleosynthetic products of Pop III stars and any possible connection between the assembly history of the Galactic halo and the ultra-faint dwarf galaxies from the CEMP stars.

This lecture consists of two topics. Below are the contents of the lecture.

Topic 1: Search for Signatures of First-Generation Stars

- Metal-poor stars
- Chemical abundances of metal-poor stars
- Carbon-enhanced metal-poor (CEMP) stars
- Signatures of nucleosynthetic products of Pop III stars from CEMP stars
- Looking forward

Topic 2: Exploration of the Galactic Halo with Metal-Poor Stars

- Dichotomy of the Galactic halo from chemical abundances
- Connection of the Galactic halo with the ultra-faint dwarf (UFD) galaxies
- Summary