HIGHLY-IONIZED GAS; PROBING ENERGETIC GALACTIC ENVIRONMENTS

Abstract

by

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We present *Far Ultraviolet Spectroscopic Explorer* (*FUSE*) and Space Telescope Imaging Spectrograph (STIS E140M) observations of the post-asymptotic giant branch star ZNG 1 in the globular cluster Messier 5 ($l = 3.°9$, $b = +47.°7$; $d =$ 7.5 kpc, $z = +5.3$ kpc). High velocity absorption is seen in C IV, Si IV, O VI, and lower ionization species at LSR velocities of ~ -140 and ~ -110 km s^{-1}. We conclude that this gas is not circumstellar on the basis of photoionization models and path length arguments. Thus, the high velocity gas along the ZNG 1 sight line is the first evidence that highly-ionized HVCs can be found near the Galactic disk. We measure the metallicity of these HVCs to be [O/H] $= +0.22 \pm 0.10$, the highest of any known HVC. Given the clouds' metallicity and distance constraints, we conclude that these HVCs have a Galactic origin. This sight line probes gas toward the inner Galaxy, and we discuss the possibility that these HVCs may be related to a Galactic nuclear wind or Galactic fountain circulation in the inner regions of the Milky Way.

Absorption from high ions (Si IV, C IV, and N V) is used to probe hot gas from the Milky Way to high-redshift primordial galaxies. However, only in our own Galaxy have they been observed with high enough spectral resolution to fully resolve the line profiles. We present an homogeneous study of the high-resolution STIS E140H (1.5-2.7 km s^{-1} resolution) spectra of the interstellar Si IV, C IV, and N V absorption along 50 Galactic sight lines. These data are complemented by *FUSE* O VI for all but 5 stars. We are able to resolve narrow components in Si IV ($\leq$ 6.5 km s^{-1}) and C IV ($\leq$ 10 km s^{-1}) undetectable at lower resolution. We find that these narrow components are ubiquitous throughout the Galaxy and constitute a large part of the total number of components and almost half of the total column density. These narrow components imply temperatures where little C IV is expected, yet considerable amounts of C IV (and Si IV) is observed. We find that photoionization from OB stars can account for very few of the narrow components. The majority of the narrow components must have been photoionized by radiation from hot cooling gas, or the remains of a hot gas that has radiatively cooled.