ULTRAVIOLET INTERSTELLAR ABSORPTION TOWARDS SK159 IN THE SMALL MAGELLANIC CLOUD

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Multiple high-dispersion IUE spectra of SK159 in the Small Magellanic Cloud (SMC) have been obtained and averaged in order to study interstellar gas associated with the SMC and, in particular, to search for evidence of SMC halo gas. A single high-dispersion IUE spectrum of SK159 was analyzed by Prévot et al. (1980). They reported the absence of C IV and only the marginal detection of Si IV at SMC velocities. The higher signal-to-noise ratio in our data allow a more definitive investigation of the absorption characteristics of these ions. SK159 is relatively cool, spectral type B0.5 Iaw (Walborn 1983) and is located in a region free of strong nebulosity. Thus the interstellar line spectrum will be less contaminated by H II region absorption than in previous studies of SMC stars. This favorable circumstance is somewhat offset by the great complexity of the underlying stellar spectrum and the resultant blending of stellar and interstellar lines. The main conclusions from our study of the SK159 spectrum are summarized as follows:

1.) The Milky Way disk and halo absorption features towards SK159, except for Al III, are very similar to those seen towards HD5980, also in the SMC. The Al III lines may be enhanced by photo-ionization from stars in the Milky Way disk.

2.) SMC H I 21-cm emission components in the SK159 direction are detected at 140 km s^{-1}, 175 km s^{-1}, and 201 km s^{-1}, corresponding to H I column densities of 1.4×10^{21} cm^{-2}, 3.3×10^{21} cm^{-2}, and 1.9×10^{20} cm^{-2}, respectively (McGee 1979; McGee and Newton 1982). From comparison with H I Lyα absorption and the other ultraviolet absorption lines, we determine the 140 km s^{-1} and 201 km s^{-1} H I clouds to be foreground to SK159 and the 175 km s^{-1} cloud to be beyond SK159.

3.) SMC ultraviolet absorption occurs at four principal velocities: 100 km s^{-1}, 150 km s^{-1}, 165 km s^{-1}, and 215 km s^{-1}.

4.) The 150 km s^{-1} absorption, seen in the low-ionization stage species, is associated with the 140 km s^{-1} 21-cm emission peak and originates in the SMC interstellar medium. Column density estimates suggest that S, Zn, and Mg are present in roughly their relative solar abundance ratios, but are deficient by a factor of $\lesssim 10$ with respect to H. The gas-phase Si/S ratio may be a factor of four less than the solar

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value. Optical data suggest that the Na/H ratio is deficient by a factor of ~10, with respect to solar abundances, and that the Ca/Na gas-phase ratio is a factor of ~35 less than the solar ratio.

5.) The gas-to-dust ratio in the 150 km s^{-1} gas is between three and eight times greater than the galactic value. The uncertainty is mainly due to uncertainty in the SMC contribution to the color excess of SK159.

6.) The 165 km s^{-1} absorption corresponds to the weak H II region surrounding SK159. Only C II*, Al III, and Si IV absorption lines are resolved at 165 km s^{-1}. The strengths of the Si IV lines are consistent with a stellar photo-ionization origin. Nebular absorption is present in the strong lines of Si III, Si II, and C II, but not resolved.

7.) The low-ionization ultraviolet absorption seen near 100 km s^{-1} and 215 km s^{-1} may be associated with global SMC H I masses detected by McGee and Newton (1981). The 100 km s^{-1} H I mass is centered on the SMC. The 200 km s^{-1} H I mass is associated with the LMC-SMC H I "bridge". The presence of ultraviolet absorption shows that neither of these H I masses is composed of primordial material.

8.) C IV absorption, with a column density of $\sim 3.6 \times 10^{13}$ cm^{-2}, is detected near 100 km s^{-1}. It is not clear if there is an exact velocity coincidence with the low-ionization absorption near 100 km s^{-1}.

9.) Si IV absorption may be present near 100 km s^{-1} with a column density of $\sim 3 \times 10^{12}$ cm^{-2}. The C IV/Si IV ratio, $\gtrsim 10$, is similar to values found in the galactic halo and is not characteristic of stellar photo-ionized gas.

10.) Our data do not rule out the possibility of an SMC halo. To determine whether the 100 km s^{-1} C IV absorption has its origin in SMC halo gas, observations of stars in a variety of locations in the SMC are required. "Coolish" stars like SK159, located in quiescent regions, are most desirable for this because contamination from nebular gas will be minimal.

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