Interstellar Absorption Lines in the Spectrum of Sigma Sco Using Copernicus Observations

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Since the launch of Copernicus in 1972, studies have been made of the depletion of gas-phase elements onto dust grains. A few stars have been studied in detail (Morton 1974, 1975, 1978; York and Kinahan 1979; York 1983; Snow 1976, 1977), resulting in a "standard" depletion pattern which has since been used for comparison. Recent developments, however, have suggested that this "standard" pattern may need to be re-examined. It has been recognized in the last few years that the curve-of-growth ambiguities in the saturated lines may be more serious than previously thought (e.g. de Boer 1979) with lines arising from low velocity dispersion gas being masked by broader lines from relatively higher velocity dispersions. Some weak, semi-forbidden lines have been detected recently which may be able to resolve some of the ambiguities. Studies of single elements have shown that depletion of carbon (Hobbs, York, Oegerle 1982) and oxygen (de Boer 1979) are much smaller than previously determined.

The high-resolution ultraviolet spectral scans of σ Sco (and three other stars; π Sco, δ Sco and ϑ Car) were originally made in 1973, but have only recently been analyzed. All these stars are bright (V 3.0) and moderately reddened. All four stars will be analyzed in detail, but σ Sco is the first one completed.

The data has broad coverage of ions, making these stars excellent candidates for determination of accurate depletions. We are using a profile-fitting analysis rather than curves-of-growth in order to determine separate abundances and depletions in components separated by several km/sec (the program and analysis procedure are described by Vidal-Madjar et al. 1977, by Snow and Meyers 1979 and by Meyers et al. 1985) In σ Sco three separate velocity components have been used for some lines. Two of the components were identified in high-resolution Na I (Hobbs 1969) at about -15 km/sec and -5 km/sec. However, in fitting S II (1250 Å , 1253 Å , 1259 Å), a third component was need at about -25 km/sec (out of range of Hobbs' data) (figure 1).

Sigma Sco in the the area of the ρ Oph cloud complex, a region which has been studied extensively. Meyers et al (1985) may have found a weak shock front in this area (velocity of about 10 km/sec). By studying this and other lines of sight in detail, we can get more information about the densities and temperatures related to weak shocks, in addition to increasing the number of stars with detailed depletion patterns.

References

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Fig 1: S II 1259.518 in σ Sco, decomposed into three components.
(solid line is observation, dotted lines are calculated Voigt profiles)