MOLECULES, GRAINS, AND SHOCKS: A COMPARISON OF CO, H I AND IRAS DATA

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We have compared the IR and H I properties, and CO content, of a set of 26 isolated, degree-sized interstellar clouds. The comparisons offer some conclusions concerning the effects of kinematics on molecular content and grain size distribution, although these conclusions are provisional because of the small sample. The departure of S_{100}/N_{HI}, where S_{100} is the 100μm surface brightness, from the theoretically-predicted value is a measure of the H_2 content of clouds. This is confirmed by the detection of CO in clouds with large S_{100}/N_{HI}. Even clouds with low column density, $\lesssim 2.4 \times 10^{20}$ H-nuclei cm^{-2}, may contain more H_2 than H I, in contrast to results obtained from UV absorption line studies. The [H_2/H I] ratio is large only for quiescent clouds.

The dependence of S_{60}/S_{100} on cloud velocity implies that fast shocks preferentially destroy large grains and/or produce small grains. The marginally defined dependence of S_{12}/S_{100} on velocity, if real, probably implies that very small grains (VSG's) are formed in shocks in the 10 to 20 km s^{-1} velocity range, and destroyed at slightly higher velocities. Two neighboring clouds have been affected by the same shock, but with different degrees of completion; comparison of these two allows us to estimate a time scale for VSG formation. Nearly *all* clouds, independently of kinematics, appear to contain VSG's.

Some members of our cloud sample emit more power in the IRAS 12μm band than in the 100μm band. Such clouds must have very large fractions of their total Carbon in the form of polycyclic aromatic hydrocarbons (PAH's), if VSG's are exclusively PAH's. Finally, the absence of correlation of S_{12}/S_{100} with S_{60}/S_{100} implies that VSG's are not formed preferentially from the breakup of large grains.