The Detection of an Extended Moving Group Near the Galactic Disk
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A radial velocity survey (median velocity precision ~ 1.0 km s^{-1}) for 879 field stars in the direction (l,b) = (277°,9°) has been undertaken with ARGUS — the bench-mounted echelle spectrograph at the CTIO 4.0m telescope. The radial velocity histogram shows a marked overabundance of stars in the range 74.0 – 76.0 km s^{-1}. We observe 18 stars in this interval whereas only five such stars (within our ~ 1° field) are expected on the basis of the Institute for Advanced Study Galaxy Model. Monte Carlo simulations indicate that this feature is significant at better than the 99% level. B, V CCD photometry is available for 4 of the 18 stars — the remaining stars have B, V magnitudes determined from APM scans of B2 and R UK Schmidt plates. Although the scatter in the photometry is appreciable, 14 of the stars occupy a roughly horizontal locus in the field color-magnitude diagram. Various considerations lead us to suspect that they are giants in an extended moving group at a distance of approximately 6 – 12 kpc, the large range being due to uncertainties concerning the age and metallicity of the group.

A Multi-transition CO and 13CO Survey of the Galactic Plane

A survey of the Galactic Plane in the (2-1) and (3-2) rotational transitions of CO and 13CO has been carried out using the 10m telescope of the Caltech Submillimeter Observatory (CSO). These data, plus previous observations of (1-0) emission from CO and 13CO obtained at the Five College Radio Astronomy Observatory (FCRAO), have been used to determine the excitation properties of the molecular gas (T_{kin}, n(H_2)) throughout the disk of the Milky Way. The bulk of the molecular gas outside the galactic center (R > 0.5 kpc) appears to be slightly colder, T_{kin} = 10-15 K, and denser, n(H_2) = 10^3-10^4 cm^{-3}, than previously assumed. There are no obvious gradients in temperature and cloud H_2 density with galactocentric radius, although the molecular clouds in the galactic center and near the peak of the galactic ring at R/R_g = 0.4 – 0.7 are on average warmer (T_{kin} ~ 15-20 K) than the molecular material at other radii. The large H_2 volume density derived from the CO data implies that a general internal property of molecular clouds is a low volume filling factor (~1-10%) for the molecular gas, implying a larger mean-free-path for ionizing photons within molecular clouds than previously assumed. A low volume filling factor would imply that high excitation lines (e.g. C^7) are not simply emitted from the outer cloud surface, but may originate throughout the cloud volume.

Oscillatory Instability of Radiative Shocks with Transverse Magnetic Field: Linear Analysis and Nonlinear Simulations
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We examine the stability of plane-parallel radiative shocks with a transverse magnetic field, for radiative cooling laws <x, partners> and the Alfven Mach number M_A = v_A/v_SH, where v_A is the average shock speed and v_SH is the Alfven velocity in the preshock medium. The equation of the hydrogen. As expected, the magnetic field has a stabilizing influence. For alpha > 0 even a relatively weak magnetic field (M_A < 8) can stabilize against all modes. For alpha > 0.5 even weaker fields (M_A < 33) are sufficient to suppress thermal instability.

We also determine the linear growth rates and frequencies of the fundamental mode and the first and second overtones for twelve pairs of the parameters alpha and M_A. A full dynamical numerical simulation of these twelve cases confirms the results of the linear analysis, and also explores the nonlinear behavior of the oscillations. In most of the unstable cases the amplitude of the shock front oscillation saturates at a level of 5% to 10% of the length of the cooling region. In the least stable cases, however, the flow develops multiple shocks.

Using a simple approximation to the cooling function for shocked interstellar gas, we show that t_c ~ 160 km s^{-1} radiative shocks in interstellar gas with n = 0.4 cm^{-3} (the "warm ionized medium" or "warm neutral medium") may be magnetically stabilized. In higher density gas, however, the magnetic field is not strong enough to appreciably affect the shock stability.