ABSTRACTS

76.09
Alternatives to a Galactic Dark Matter Distribution

Observational constraints on the dynamical mass of our galaxy are considered in the context of the possibility that the gravitational coupling constant is distance dependent. A systematic analysis of the observational data clearly shows that there are no significant bounds on possible spatial variations in Newton's constant at long distance scales. Furthermore, the galactic dynamical data are well modeled by the non-dynamically observed galactic mass distribution and a single parameter that describes an additional long range force. This empirically motivated formulation appears to be consistent with other observational constraints.

Session 77: Star Formation
(First Floor)
Display Session

77.01
Formation of Giant Molecular Clouds in Global Spiral Structures: The Role of Orbital Dynamics and Cloud-Cloud Collisions*.
W. W. Roberts, Jr., G. R. Stewart (U. Virginia)

We investigate the different roles played by orbital dynamics and dissipative cloud-cloud collisions in the formation of giant molecular clouds (GMCs) in global spiral structures. The interstellar medium (ISM) is simulated by a system of 'particles', representing clouds, which orbit in a spiral-perturbed, galactic gravitational field. Detailed comparisons are made between the results of cloud-particle simulations in which the cloud-particles collide inelastically with one another and give birth to and subsequently interact with young star associations and the results of stripped-down simulations in which cloud-cloud collisions and star formation processes are omitted. Large GMC-like associations of smaller clouds are efficiently assembled in spiral arms and subsequently dispersed in interarm regions largely by the orbital dynamics alone. The overall magnitude and width of the global cloud density distribution in spiral arms is very similar in the collisional and collisionless simulations. The results suggest that the assumed number density and size distributions of clouds and the details of individual cloud-cloud collisions have relatively little effect on these features. In the simulations with shorter mean free paths, pronounced shock-like density and velocity profiles occur. In the simulations with longer mean free paths and in the collisionless simulations, we find more symmetric, less shock-like density and velocity profiles. The natural tendency of orbits to crowd together in spiral arms is enhanced by the temporary trapping of clouds in spiral arm potential minima for periods up to 50 Myr. Dissipative cloud-cloud collisions play an important steadying role for the cloud system's global spiral structure. Dissipative cloud-cloud collisions also damp the relative velocity dispersion of clouds in massive associations and thereby aid in the effective assembling of GMC-like complexes. The assembly of these GMC complexes from smaller clouds is remarkably efficient even if collisional coalescence of individual clouds is inefficient.

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77.02
The Milky Way in Molecular Clouds: A CO Panorama
T.M. Dame, H. Ungerechts, and P. Thaddeus (CFA)

Two nearly identical 1.2 m telescopes, one in New York City, the other at Cerro Tololo, Chile, were used to produce a panorama of the entire Milky Way in the J=1→0 line of CO at 115 GHz. Sixteen separate CO surveys, most of them fully sampled at an angular resolution of 1/2°, were combined to cover a strip at least 10° wide in latitude encompassing the entire Galactic plane, with extensions that include the high-latitude clouds of Gould's Belt. The composite survey, containing more than 31,000 spectra, fully samples 7700 deg², nearly a fifth of the entire sky.

77.03
The Kinematical Structure of High-Latitude Molecular Clouds
L. Magnani, L. Blitz (U. of Maryland), E.A. Lada (U. of Texas)

The high-latitude molecular clouds show a complex kinematic structure at length scales ranging from the size of a cloud (1-5 pc) to the size of small clumps within the cloud (0.1 pc). The internal velocity dispersion of the clouds and the clumps which comprise the clouds suggests that the objects are not gravitationally bound and are breaking up or expanding. The unbound condition persists to the smallest observable length scale (0.03 pc).

CO(J=1-0) channel maps and position velocity maps for some of the clouds are presented in order to study the kinematics of the gas. The fragmented structure evident in the low-sampled maps of Magnani, Blitz, and Mundy (1986; Ap.J. 275, 402) is also seen in the fully-sampled, higher resolution (1°) maps obtained with the IRAM 12 m telescope.

Pressure from the ambient interstellar medium is not, in most cases, sufficient to confine the clouds or clumps. However, magnetic fields of strength 10-100 mG can provide enough pressure to keep the clouds or clumps from breaking up.

If the clouds are indeed expanding and breaking up, their lifetime based on a clump crossing time is 10^6 yr. These objects may be among the youngest molecular clouds. In addition, the age estimate for the high-latitude clouds is less than the timescale needed for star formation or for the cloud chemistry to reach equilibrium.

77.04
Comet-like Clouds at High Galactic Latitudes
S. F. Odendahl (NRL/SPA)

A study of the Draco Molecular Cloud by Odendahl and Richard (1987; submitted) using the IRAS 100 μm data, has shown it to have a cometary appearance with a well-defined nucleus, and several plumes of material extending from the nucleus. This cloud is believed to be falling onto the galactic plane, and the authors suggest that its morphology is consistent with low Reynolds number hydrodynamics. The nucleus is nearest the galactic plane at an altitude of 1-2 HI scale heights, and the plumes indicate that mass is being lost from the nucleus at a rate of 10^5 M☉/yr.

A search through the remaining 100 μm IRAS sky images has resulted in the discovery of 14 other clouds having a comet-like appearance. Their far-IR properties will be discussed, and compared with those of the Draco Cloud, which represents the morphological archetype for this class of objects. The optical data for these clouds, obtained from the Palomar Observatory Sky Survey and ESO Southern Extension, will also be discussed. Half of the candidate clouds appear to have young stars embedded in their nuclei suggesting that the dynamics that give these clouds their