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3D MHD Modeling of the Gaseous Structure of the Galaxy.

Gilberto C. Gómez

University of Wisconsin, Department of Astronomy, 475 N. Charter St., Madison, WI, 53706, U.S.A.

Donald P. Cox

University of Wisconsin-Madison, Department of Physics, 1150 University Ave., Madison, WI, 53706, U.S.A.

Abstract.
We show the preliminary results of our 3D MHD simulation of the ISM flow in the Milky Way near a spiral arm. We find a strong shock above $z = 400$ pc, which slants outwards from the arm in the midplane, with downward velocities of up to 20 km/s. At low z a hydraulic jump behavior is observed, as suggested by Martos & Cox (1998). Little interarm structure is found in a two-armed case, while broken arms and bridges are frequent in four-armed cases. Greater structure is expected when we include the cooling of denser regions.

As an example of the significance of such dynamics, we compared the obtained velocity field with that of a purely circular rotation, and found that an observer inside the galaxy should see radial velocity differences of up to 20 km/s, which can lead to errors in distance estimations of several kpc, even for nearby gas.

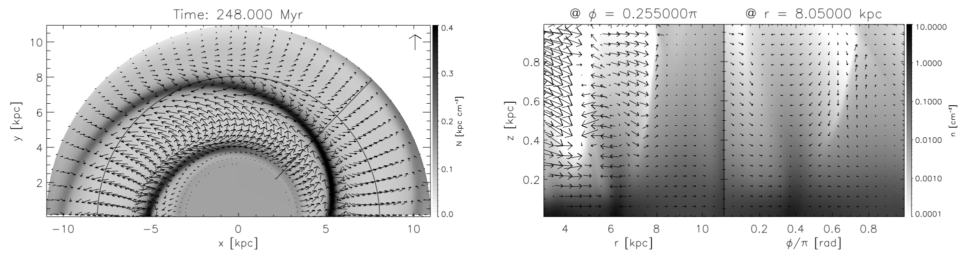

Figure 1. The left panel shows the column density of the simulation for the two arm case. The continuous lines show the position of the slices in the other panels. The arrow in the upper right corner represents 50 km/s. The panels on the right show density cuts at $\phi = \pi/2$ and $r = 8$ kpc. In the $x - y$ and the $\phi - z$ panels, the gas flows from the left and, in all cases, the velocity plotted has the initial state subtracted; therefore arrows pointing against the rotation really mean that the gas slows down. All the simulation is inside corotation.