01.03.08 Simple Model of the Galaxy, W.L.H. Shuter, UBC. Published 21 cm and CO data have been reanalyzed and indicate that the rotation curve of the galaxy is essentially flat from within 1 kpc of the galactic center to the edge of the galaxy at \( \approx 15.5 \) kpc from the center. The velocity of rotation is found to be \( 185 \pm 9 \) km s\(^{-1}\). It is shown that a rotation curve of this type can be produced by a mass density per unit area roughly proportional to the reciprocal of the distance from the galactic center. Predictions of the resulting model are compared with observations.

This work was performed under the auspices of the U.S. Department of Energy by the Lawrence Livermore National Laboratory under contract No. W-7405-ENG-48.

01.04.07 Viscous Effects in the Gas Flow in Barred Spirals, G.D. van Albada, NRAO, and W.W. Roberts, Jr., U. of Virginia — The dark, narrow dust lanes often observed offset along the leading edges of the bar in barred spirals are now generally identified as tracers of large-scale galactic shocks. Roberts, Huntley, and Van Albada (1979, Ap.J. 233, 67) in a 'steady-state' study identify viscosity as an important parameter. They furthermore find a strong post-shock outflow in a representative case (model 'T+5'), a phenomenon not previously observed in any of the two-dimensional, time-evolutionary studies. The aim of the present work is to identify the effects of a lower viscosity and to investigate the possibility of post-shock outflow in time-evolutionary calculations. The lowering of the viscosity is obtained by using a different code (Godunov's method) and by progressively reducing the cell size. The latter is possible due to the use of a windowing technique with appropriate boundary conditions. The progressively increased resolution and reduced viscosity lead to the following results (model 'T+5'):

1) The shock shifts back toward the minimum of the potential, but remains offset.
2) Post-shock outflow is observed in a region approximately 100 pc wide and several kpc in length.
3) Gas pile-up in the region where the bar breaks into spiral arms seems even more pronounced than in our 'steady-state' calculations.

In the actual interstellar medium, the viscosity is largely due to inhomogeneities (e.g. cloud and inter-cloud components). The lack of star formation in bars and the smoothness of the dust lanes may indicate a more homogeneous medium with a low viscosity. This work was supported in part by the National Science Foundation through Grant AST-7909935.

01.05.08 Hydrodynamic Simulation of Galactic Disks, P. R. WOODWARD, Lawrence Livermore National Lab—An especially powerful numerical method for the simulation of galactic disks has been developed based upon the representation of the stellar dynamics of a cold, rotating disk of stars by the hydrodynamics of an appropriate gaseous disk. The computations are performed in polar coordinates in order to obtain the most accurate treatment of angular momentum conservation. In addition, force balance in an unperturbed state is used to remove large terms of opposite signs from the dynamical equations. Self-gravity is included, so that the code is ideally suited to the study of the onset of spiral instability in a galactic disk. Calculations of a 2-D model of the disk of the galaxy M81 will be presented.

01.06.08 "Galaxy Warps and the Quest for Properties of the Unseen Halo—Dynamical Considerations", G. Bertin, MIT and J. W-K. Mark, LLL

The bending (warp) of galaxy disks is unstable in the presence of the more slowly rotating spheroidal subsystem (bulge-halo), somewhat like a flag waving in the wind. Wave amplification is driven by the torque between the non-axisymmetric bending disk and spheroidal matter (G. Bertin and J. W-K. Mark 1980, A & A, in press). This internal excitation mechanism can explain the existence of warps in isolated galaxies, in addition to the extra amplification needed in some externally driven warps (G. Hunter and A. Toomre 1969, Ap. J. 155, 747). Our theoretical considerations yield a simple scaling law \( r_\delta \propto \Sigma \propto \rho \) constant relating the maximum height \( H(r) \) of the warp at a given radius \( r \) to the local inertia through the surface density \( \Sigma(r) \). When applied to the observed flat rotation curves, our theory immediately rejects the unrealistic assumption that most of the mass lies in the disk, since this requires \( H(r) \propto r^4 \). This constraint on the disk density allows a determination of the halo distribution for a given rotation curve (see following abstract). Our dynamical arguments are not biased a priori by assumptions of large halos, thus allowing the observations to determine the final result.

01.07.08 Galaxy Warps and the Quest for Properties of the Unseen Halo—Preliminary Results for Three Galaxies, G. Lake, UCB and J. W-K. Mark, LLL

We apply a recent theory of bending waves (see previous abstract) to separate disk and halo mass distributions. For our galaxy, we find the surface density is very nearly exponential from \( R_0 \) (the