Disk Formation with Spherical Harmonics

B. M. Sutin (UCSC/LICK)

Disk formation is a common phenomenon in astrophysics, occurring in both star and galaxy formation. Dissipation in the gas takes place over a large dynamic range. A method is presented for combining smoothed particle hydrodynamics and spherical harmonic expansions, which is ideal for investigating the hydrodynamics of self-gravitating gas.

History of the Milky Way Star Formation Rate from the White Dwarf Luminosity Function

E. Noh, J.N. Scalo (UT)

The sensitivity of the white dwarf luminosity function (WDLF) to the history of the star formation rate (SFR) is examined. It is shown that the WDLF is much more sensitive to the SFR than to variations in the IMF. If the SFR is assumed to be a smooth and monotonic function of time, existing observations of the WDLF require that the ratio of the SFR within the past 1 Gyr to the SFR 4-10 Gyr ago be not much different from unity, with the main uncertainty being the white dwarf cooling times at the faintest luminosities. The WDLF is also capable of revealing non-monotonic SFR behavior, such as bursts and lulls. We show that a marginal feature in the WDLF at log L/L⊙ = -2 is identified with a burst of star formation which occurred 0.3 Gyr ago, consistent with two other lines of evidence. If the feature is real, the burst is constrained to have a duration < 0.1 Gyr and must have produced roughly a tenth of the stars in the solar neighborhood. WDLFs computed using the SFR histories derived from the isochrone and chromospheric age distributions of Twarog (1980) and Barry (1988), both of which show a definite maximum around 5-8 Gyr ago, are compared with the observations. The major discrepancy is that both studies find significant numbers of very old (> 10 Gyr) stars, which yield far too many very faint white dwarfs, at least for the cooling rates adopted here. Either the ages of the oldest stars from both methods are overestimated, the low luminosity cooling rates are too large, or the observed WDLF at lowest luminosities should be larger by a factor of 10-100. We emphasize the ability of larger WDLF samples to test definitively for irregularities in the SFR history for all times less than about 4.5 Gyr in the past. A derivation of the relation between the WDLF, SFR, and IMF is given in the Appendix.

A Second-Order Numerical Model of Protostellar Cloud Collapse and Nebular Formation

E.A. Myhill and W.M. Kaul (UCLA)

We are developing a three-dimensional protostellar collapse code which includes the effects of self-gravity, rotation, and radiative transfer. The hydrodynamic equations of motion are advanced with a second-order Van Leer difference scheme in Cartesian coordinates. This differs from previous collapse models which largely have used first-order numerical schemes and curvilinear coordinates. Radiative transfer is handled with the Eddington approximation. Fourier transforms and Green's functions are used to solve Poisson's equation for density. The numerical technique will be discussed in detail, and preliminary results will be presented. Ultimately, we intend to investigate the evolution of density perturbations in near solar mass clouds.

Session 23: Astrometry

VLBI Measurements of Earthquake Displacements in California and Alaska


The NASA Crustal Dynamics Project uses Very Long Baseline Interferometry between mobile antennas and fixed base stations to measure the position of several sites in California and Alaska with precisions of better than one centimeter. Measurements over the last 5 to 6 years allow us to determine vector velocities of these sites with uncertainties of a few millimeters per year. Three sites in the San Francisco Bay area (Fort Ord, the Presidio, and Pt. Reyes) were recoupled shortly after the major earthquake of 17 October, 1989, in order to measure possible coseismic displacements by comparison with previous observations. Coseismic displacements of about 10 cm are expected for some of these sites. We will present the results from several observing sessions which span the month after the earthquake.

An 8 cm displacement of the Cape Yakataga site on the south coast of Alaska occurred between our summer measurement sessions in 1987 and 1988. This movement resulted from two earthquakes of magnitude 7.3 which occurred about 100 km south of Cape Yakataga, in the Gulf of Alaska. These measurements are consistent with the expected coseismic displacement caused by a rupture at the earthquake site resulting in a 4 meter offset about 150 km long.

Astrometric Analysis of Stellar Images

L. F. Kells (Independent)

Three approaches to analysis of stellar images for parallax will be presented. W. A. Smart, in his "Textbook of Spherical Astronomy", does not consider this.

1. With proper motion, lines of sight will cross at a common point only when the line between observation points on the earth's orbit is projected onto a plane parallel to the plane containing the stellar images and the projection (the "apparent base line") is parallel to the direction of proper motion. Images will fall on a single line only in this case, and direct correction for proper motion may be made. When the apparent base line is not parallel to proper motion, separate parallel lines of proper motion will be obtained from the ends of the earth's chord and correction must be made on the line through the image being corrected.

2. A sinus curve will be obtained through images from many points on the earth's orbit.