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100 AU in diameter.

We now have a second set of HST observations made immediately after the refurbishment mission that provides even greater detail and reveals even more of these objects. About half of all the low-luminosity stars are proplyds. The poster paper describes quantitative tests about their fundamental structure and addresses the question of whether the circumstellar material is a disk or shell. One object (HST16) is seen only in silhouette against the nebula and is easily resolved into an elliptical form of optical depth monotonically increasing toward the central star.

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A STUDY OF ANGULAR MOMENTUM LOSS IN BINARIES USING THE FREE LAGRANGE METHOD. A. M. Rajasekhar, Department of Physics and Astronomy, Louisiana State University, Baton Rouge LA 70803, USA.

The evolution of a binary star system depends greatly on the angular momentum losses in the system brought about by gravitational radiation and mass outflow (e.g., evaporating winds and magnetic braking) from the secondary component of the binary. Using a three-dimensional hydrodynamic fluid code based on the free Lagrange method, we study the loss of specific angular momentum from a binary system due to an evaporative wind from the companion of a millisecond pulsar. We consider binaries of different mass ratios and winds of different initial velocities and in particular attempt to model the system PSR 1957+20. We are in the process of incorporating the effect of the radiation force from the pulsar and the magnetic field of the companion on the mass outflow. The latter effect would also enable us to study magnetic braking in cataclysmic variables and low-mass X-ray binaries.

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EVOLUTION OF PROTOPLANETARY DISKS WITH DYNAMO MAGNETIC FIELDS. M. Reyes-Ruiz[1] and T. F. Stepinski[2], [1]Department of Space Physics and Astronomy, Rice University, Houston TX 77251, USA, [2]Lunar and Planetary Institute, 3600 Bay Area Boulevard, Houston TX 77058, USA.

The notion that planetary systems are formed within dusty disks is certainly not a new one; the modern planet formation paradigm is based on suggestions made by Laplace more than 200 years ago. More recently, the foundations of accretion disk theory where initially developed with this problem in mind by von Weizsäcker [1], and in the last decade astronomical observations have indicated that many young stars have disks around them. Such observations support the generally accepted model of a viscous Keplerian accretion disk for the early stages of planetary system formation. However, one of the major uncertainties remaining in understanding the dynamical evolution of protoplanetary disks is the mechanism, or mechanisms, responsible for the transport of angular momentum and subsequent mass accretion through the disk. This is a fundamental piece of the planetary system genesis problem since such mechanisms will determine the environment in which planets are formed.

Among the mechanisms suggested for this effect is the Maxwell stress associated with a magnetic field treading the disk. Due to the low internal temperatures, and resulting low degree of thermal ionization, through most of the disk, even the question of the existence of a magnetic field must be seriously studied before including magnetic effects in the disk dynamics. On the other hand, from meteoritic evidence it is believed that magnetic fields of significant magnitude existed in the earliest, PP-disk-like, stage of our own solar system's evolution. Hence, the hypothesis that PP disks are magnetized is not made solely on the basis of theory. Previous studies have addressed the problem of the existence of a magnetic field in a steady-state disk and have found that the low conductivity results in a fast diffusion of the magnetic field on timescales much shorter than the evolutionary timescale (~3×10^6–10^7 yr from astronomical observations). Hence the only way for a magnetic field to exist in PP disks for a considerable portion of their lifetimes is for it to be continuously regenerated. Levy [2] has suggested this could be accomplished by an α–ω dynamo mechanism working within the disk. Stepinski and Levy [3] derived a criterion to determine the ability of the dynamo to regenerate the magnetic field, and Stepinski et al. [4] have shown that a magnetic field may exist in certain parts of the disk depending on the disk properties. Because the dynamo mechanism depends on the turbulence for its excitation, the generated magnetic field will supplement, rather than replace, the turbulent viscosity in transporting angular momentum. In the present work, we present results on the self-consistent evolution of a turbulent PP disk, including the effects of a dynamo-generated magnetic field.

For our calculations, to include the effects of the large-scale dynamo magnetic field, we redefine the Shakura and Sunyaev dimensionless turbulence parameter, α_{ss}, to

$$\alpha_{eff} = \alpha_{ss}\left(1 + \frac{6}{\beta\alpha_{ss}^{1/2}}\right)$$

where β is the ratio of gas to magnetic pressure and we have assumed that $B \sim B_\phi$ and $B_r \approx \alpha^{1/2} B_\phi$. The magnetic pressure is also taken into account by writing

$$P = P_{gas}\left(1 + \frac{1}{\beta}\right)$$

With these we solve the standard set of time-dependent α disk equations. The opacity of nebular material is considered to be given by the piecewise continuous power laws used by Ruden and Pollack [5]. The self-consistent solution of disk structure in the presence of a magnetic field is calculated as follows. At each timestep, we compute the structure of a uniform α_{ss} nonmagnetic disk. The ionization degree profiles of such disks are calculated from equilib-