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Disks in regions of star formation

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SUMMARIES OF PAPERS PRESENTED AT
THE RAS SPECIALIST DISCUSSION ON
ASTROPHYSICAL APPLICATIONS OF ACCRETION DISKS

Friday 1982 October 8 at 10^h 30^m
in the Scientific Societies' Lecture Theatre, Savile Row

DISKS IN REGIONS OF STAR FORMATION

By Glenn J. White
Queen Mary College

Amongst recent exciting observational discoveries concerning regions of active star formation has been the detection of a number of active molecular clouds which show evidence for bipolar ejection of high-velocity molecular gas from their cores. These cores often appear to have spatial distributions similar to that expected for disk-like structures. The core densities lie typically in the range 10^4 to 10^6 hydrogen molecules per c.c., and the masses of these disks can be up to several hundred solar masses.

Compact infrared sources with luminosities around 10^3 to 10^5 Suns, maser sources, Herbig-Haro objects and molecular hydrogen emission are associated with most of the known examples of these objects. It seems likely that these bipolar and highly anisotropic gas flows may result from confinement of a stellar wind by a large circumstellar disk. The formation mechanism of such disk structures is not clear at the moment; however, it seems likely that they represent a rather common stage in the star-formation process, where gravitational collapse of some turbulent cell in a giant molecular cloud accretes molecular material from the cloud to form a rotating core a few tenths of a parsec in size. This eventually will both accrete further material from the outer regions of the cloud, and lead to the formation of one or more centrally located star(s). The interaction of the stellar wind from the newly formed star(s) with the accretion disk then leads naturally to the bipolar appearances which are observed. Objects of this class appear to offer exciting prospects for the study of accretion disks, since their structures can readily be resolved both spatially and kinematically.

PROTOPLANETARY DISKS

By J. Papaloizou
Queen Mary College

Models of the structure and evolution of the Solar nebula show that the nebular mass and the probable temperatures required imply convective instability. We can make different assumptions about the turbulent viscosity, and these lead to disks resulting in different models for the formation of the Solar System. A large viscosity implies no gravitational instabilities, favouring an accumulation from planetesimals, while a low viscosity would result in a gravitationally-unstable disk which could provide gaseous proto-planets. In either case the lifetime of the disk is found to be about 10^6 years.

The proto-planets might affect the behaviour of the disk. Tidal interaction could expel material from the neighbourhood of the proto-planet and also