

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
RESEARCH AND TECHNOLOGY RESUME

TITLE

The Evolution of Young Stellar Object Disks and Their Environment

PERFORMING ORGANIZATION

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DESCRIPTION (a. Brief statement on strategy of investigation; b. Progress and accomplishments of prior year; c. What will be accomplished this year, as well as how and why; and d. Summary bibliography)

a. Strategy: By carrying out direct imaging and spectroscopic observations of young, pre-main sequence stars in nearby molecular clouds we have begun:

- to define the frequency with which disks of ~ solar system size and mass form around young stars, and to understand the timescale for disk evolution;
- to characterize the early radiation (ultraviolet and kev particle) environment of circumstellar disks through study of the evolution of stellar winds, wind/disk interactions and the uv and optical emission characteristics of young stars;
- to understand the evolution of the solid and gaseous constituents of disks through observations of absorption features in circumstellar gas, broad emission features produced by organic compounds on grain surfaces, and absorption features (e.g. ice) produced. in grain mantles.

These programs offer the possibility of relating results from astrophysical studies of the environment of newly-formed stars to the record of planet formation preserved in the solar system.

b. Accomplishments:

We completed a spectroscopic survey of 30 T Tauri stars with ages ranging from $\sim 2 \times 10^5$ to 3×10^7 years. From analysis of [O I] and [S II] emission lines, we conclude that all but two of the stars in our sample are surrounded by optically opaque disks of dimension ~ 50 au. The two remaining objects show evidence consistent with partial disk clearing (at an age $\sim 3 \times 10^6$ yr).

R and I band CFHT observations yielded detections of disks of dimension ~ 100 au surrounding 5 additional T Tauri stars.

Analysis of the spectra of low mass young stars of the FU Ori class provide *kinematic* evidence of accretion disks through detection of a correlation between observed absorption line width and the lower excitation potential of the transition; low excitation lines formed in the cooler, outer parts of the disk are narrower than their high excitation counterparts.

c. Anticipated Accomplishments:

We expect to complete an analysis of the infrared emission properties of a large (~ 60) sample of low mass young stellar objects which will permit us to characterize the dependence of disk dust mass on the age of the parent star and to place astrophysical limits on the epoch of disk clearing.

ORIGINAL PAGE IS
OF POOR QUALITY

- A Study of the Morphology and Kinematics of the Dense Gas Associated with Star-Forming Regions," 1986, Ap.J., 308, 134 - with M.C. Heyer, R.L. Snell, P.F. Goldsmith, K.M. Strom, G.L. Grasdalen, R.W. Capps and D. Thompson.
- Forbidden Line and H α Profiles in T Tauri Star Spectra: A Probe of Anisotropic Mass Outflows and Circumstellar Disks, 1987 Ap. J. 321, 473 - with S. Edwards, S. Cabrit, I. Heyer, K.M. Strom and E. Anderson.
- CS Observations of L1551: No Rotating Disk, 1987, Ap. J. 317, L95 - with G.H. Moriarty-Schieven, R.L. Snell and G.L. Grasdalen.
- Images of Star Forming Regions. II. The Circumstellar Environment of L1551 IRS 5, Astronomical Journal, submitted July 1987, - with B. Campbell, S.E. Persson and G.L. Grasdalen.
- The Magnetic Field Geometry in the Vicinity of HH7-11/HH12 and HH33/HH40, A. J., (in press; December, 1987), - with M.H. Heyer and K.M. Strom.
- Luminosity Excesses in Low Mass Young Stellar Objects: A Statistical Study, Astronomical Journal, submitted August, 1987, - with K.M. Strom, S.J. Kenyon and L. Hartmann.
- A Detailed Study of The Lynds 1551 Star Formation Region, Astrophysical Journal, submitted June, 1987, - with J.T. Stocke, P.M. Hartigan, K.M. Strom, E.R. Anderson, L.W. Hartmann and S.J. Kenyon.
- Energetic Winds and Circumstellar Disks Associated with Low Mass Young Stellar Objects, 1987, "NATO Advanced Study Institute: Galactic and Extragalactic Star Formation: ed. R. Pudritz and M. Fich (Dordrecht: Reidel; Holland) with K.M. Strom and S. Edwards.
- Energetic Winds Associated with Young Stellar Objects 1987, "Fifth Cambridge Symposium on Cool Stars" ed. J. L. Linsky and R. Stencel Springer-Verlag (in press).
- The Magnetic Evolution of the Taurus Molecular Clouds. I. Large-Scale Properties, 1987, - with M.H. Heyer, F.J. Vrba, R.L. Snell, F.P. Schloerb, P.F. Goldsmith, and K.M. Strom.
- Energetic Winds from Low Mass Young Stellar Objects, ed. Springer-Verlag, in press (1987), with S. Edwards.