Bok, B.J., and Cordwell, C.S.: 1973, In Molecules in the Galactic Environment, eds. M.A. Gordon and L.E. Snyder (Wiley: New York).
Colomb, F.R., Poppel, W.G.L., and Heiles, C.: 1980, Astron. Astrophys. Suppl. Ser. 40, 47.
Mackee, C.F., and Ostriker, J.P.: 1979, Astrophys. J. 218, 148.
Miyama, S.: 1985, IAU Symposium No. 115 (this book).
Ohtani, H., Ichikawa, T., Sasaki, T., Saito, K., and Tsujimura, T.: 1983, Memoires of the Faculty of Science, Kyoto University, Ser. A, XXXVI, 291.
Rossano, G.S.: 1980, Astron. J. 85, 1218.
Sandage, A.: 1976, Astron. J. 81, 954.
Tomita, Y.: 1985, Proceedings of the 3rd Asian-Pacific Regional Meeting of the IAU.

MONTMERLE: Regarding "intersecting filaments". Are some of these intersections real, or are they just a perspective effect on a given line of sight? If they are real, do you have a suggestion as to their origin?

TOMITA: I think that there are two types of intersecting filaments: a) real intersections which are due to interactions between a SN shell and a filamentary cloud, we can see an example of this type in the Taurus region; and b) apparent intersections produced by projection effects without any physical connection.

MEASUREMENT OF MAGNETIC-FIELD STRENGTHS IN MOLECULAR CLOUDS: DETECTION OF OH LINE ZEEMAN SPLITTING

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We report here the first results of an extended program to measure magnetic-field strengths in interstellar molecular clouds. The very large radio telescope located near Nançay, France, has been used to measure the Stokes-parameter I and V spectra of the 1665 and 1667 MHz lines of OH in emission and in absorption from extended (non-masing) molecular clouds. Signals in the V spectra are produced by Zeeman splitting of the spectral lines; we derive magnetic-field strengths or limits from these data.

Zeeman splitting of OH lines in absorption was certainly detected toward two sources and probably toward a third. Definite detections were achieved for the molecular cloud associated with the NGC 2024 H II region and for a nearby dark cloud in the direction of the more distant H II region W 22; the respective magnetic fields are +38 and -18 μG. Toward the W 3 continuum position Zeeman splitting was probably detected, but there is a possibility of confusion with the effects of masers; the derived magnetic field is +73 μG.

Toward the other six clouds observed only upper limits to magnetic-field strengths were achieved. The molecular clouds observed and the upper limits to the fields are L134 (32 μG), ρOph (71 μG), W40 (20 μG), a nearby dark cloud in the direction of W51 (24 μG), L889 (32 μG), and TMC1 (38 μG).

Comparison of our observational results with the theoretical predictions of the detailed magnetohydrodynamic calculations by Mouschovias (1983, "Solar and Stellar Magnetic Fields"; I.A.U. Symposium No. 102, p. 479) of collapsing magnetic clouds has been made. Fig. 1 shows that the observations are consistent with the theory.

Preliminary results on Zeeman work in the direction of Orion A (Troland, Crutcher and Kazès, 1986, to be published in Ap. J. (Letters)) indicate a line of sight magnetic-field strength of -125±20 μG derived from the 18 cm OH mainlines in absorption. At the same position, we find an H I Zeeman effect equivalent to a magnetic-field of -49±4 μG. Thus, the magnetic-field in the molecular gas toward Orion A is significantly stronger than that in the atomic gas. We estimate densities in the atomic and molecular regions toward Orion A, and we find that for this region the data are consistent with $B \propto n^k$, $k \approx 0.3$.

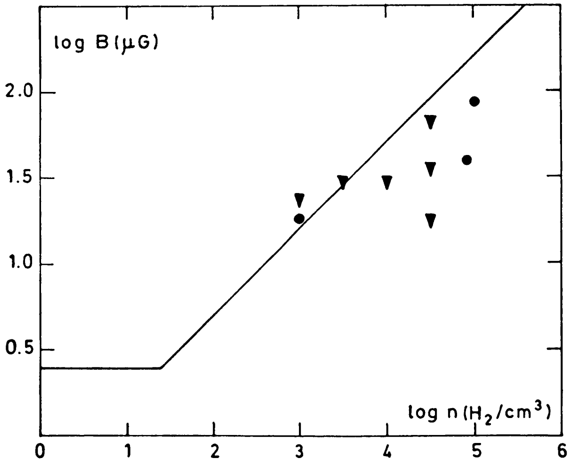

Fig. 1. The Nançay OH Zeeman results for the magnetic-fields in molecular clouds plotted against the gas densities of clouds. Filled circles correspond to the detected fields in NGC 2024, W22 and to a possible field strength in W3. Upper limits to the magnetic-field are plotted as downward pointing triangles at the upper limit value. The line is a simplified version of the theoretical predictions (Kazès and Crutcher, 1986, submitted to Astron. and Astrophys.).

WILSON: Could you comment on the assumptions used in the estimates of the density?

KAZES: The estimates of the H_2 density are based, principally, on a multitransition study of millimeter lines in molecular clouds. Also, for each Zeeman observation, we have assumed that the OH line could originate either in a lower density envelope of the molecular core, or in the high density core itself, or in both, depending upon the sampling of the telescope beam.

MOUSCHOVIAS: Congratulations! Your results are a sight for sore eyes. I have two points to make, useful for comparison of observations with theory. (1) The density n_0, beyond which the theoretical curve of log B - log n which you showed acquires a slope $k = \frac{1}{2}$, is exactly proportional to $M^{-\frac{1}{2}}$ where M is the mass of the cloud. S_0, the curve should be shifted to the right for your lower-mass clouds. (2) Recent collapse calculations accounting for ambipolar diffusion show that ambipolar diffusion sets in, typically, at densities $10^5 cm^{-3}$ or so and, therefore, little (if any) enhancement of the field strength should be exhibited above such densities, (see 1985, Ap. J. 291, 772). This makes the excellent agreement between theory and observations to which you have referred even better.

KAZES: I agree; in fact I did not draw the theoretical curve for lower mass clouds.

A HISTORICAL REVIEW OF STAR FORMATION: OBSERVATION AND THEORY

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We present a historical review of evidence for ongoing star formation in our Galaxy beginning with the discovery that interstellar space is not empty. The discoveries of interstellar dust, interstellar hydrogen and molecular clouds are reviewed. Observational investigations of dark clouds are then traced from the photographs of Edward Emerson Barnard to contemporary studies of their molecular constituents. A historical overview of observational evidence for new-born stars includes T-Tauri stars, young stellar clusters, sequential star birth and infrared stars beginning with Alfred Joy, Merle Walker, Becklin, and Neugebauer, and Adrian Blaauw and continuing to giant molecular clouds and IRAS. Theoretical studies of gravitational collapse and the early stages of stellar evolution are also placed within a historical context.