Seventy Excited States of H_2^+ and their Implications on Stark Broadening of the Hydrogen Spectrum. SANG JEAN CHO (present address: *University of Florida*) AND WENDELL C. DEMARCUS, *University of Kentucky*.—Eigenvalues and eigenfunctions for 70 states of H_2^+ have been derived for a wide range of internuclear separations. At infinite separation these states merge into the first five levels of neutral hydrogen. The spectrum of H_2^+ is also calculated for various internuclear separations. The results show that simple Stark broadening is not adequate to describe the splitting when the electron density exceeds 10^{16} cm^{-3} . Higher-order effects and exchange splitting are then important. Some estimates are made of the depression of the series limit of hydrogen considering (at present) only the effects of the positive ions and the results are compared with the Inglis-Teller formula.

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$H\beta$ Line Profiles for Rapidly Rotating Early-Type Stars. GEORGE W. COLLINS, II, AND J. PATRICK HARRINGTON, *Perkins Observatory*.—This paper is concerned with the calculation of $H\beta$ absorption line profiles for rapidly rotating early-type stars. The effects of gravity darkening, limb darkening, and shape distortion due to rapid rotation have been included. The distribution of temperature with optical depth has been assumed to be that of a nongray atmosphere having an effective temperature and surface gravity appropriate to the local position on the star. The assumptions used are essentially those used in a similar study of continuum radiation (Collins, to be published).

The results indicate that the profile of the wings of $H\beta$ are quite insensitive to the amount of rotation and the aspect of the star. However the core of the line is influenced by both the rotation and the aspect. The effects of gravity darkening and limb darkening are qualitatively the same as those estimated by Slettebak (*Astrophys. J.*, 110, 498) for sharp lines.

The Formation of Arms in Barred Spirals. J. M. A. DANBY, *Yale University Observatory*.—Many barred spirals have condensations or blobs at the ends of the bars. A collinear configuration consisting of a bar and two blobs is unstable to the extent that it might be expected to become unrecognizable after one rotation of the bar. Yet actual configurations remain essentially unchanged over several revolutions, for the blobs are usually the seats of well-formed arms.

In a reference system rotating with the bar, the equipotential surfaces of the bar will have saddle or

librational points beyond the ends of its longest axis; these are positions of unstable equilibrium, but retrograde periodic orbits around them are possible. It is suggested that a blob initially consists of a shifting population of bodies, and appears as a condensation simply because its members are moving relatively slowly. Most members return to the vicinity of the bar. Those that escape form a thin, well-defined spiral arm, regardless of the direction with which they escape from the point of libration, and, within reason, regardless of the speed with which they leave. The zero-velocity curves at this point seem to have a strong "focusing" effect on the orbits.

The mean rotation of a blob is direct. If a blob becomes large enough to have a local gravitational influence, the region from which matter can escape from the system lies on the side away from the bar. The orbits of escaping particles continue to form thin spiral arms.

Lack of Effect of Io upon Jovian 3.75-cm Emission. JOHN R. DICKEL, *University of Illinois*.—A recent investigation by Bigg (*Nature* 203, 1008, 1965) has shown that the recording of decameter wavelength radiation from Jupiter depends not only on the Jovian longitude which faces the earth but also upon the relative position of the satellite Io in its orbit. Since the decameter bursts are probably associated with the magnetic field of the planet, the author decided to see if Io had any effect on the synchrotron emission generated within the radiation belts in Jupiter's magnetosphere. The position of Io was plotted against the results of observations at 3.75 cm, which were taken with a polarimeter on the 85-ft radio telescope at the University of Michigan. The variations observed in flux density, degree of polarization, and position angle of the polarized emission from Jupiter can be attributed to the rotation of the planet; no correlation was detected between the position of Io and the variation of the polarized emission. Therefore, while Io is observed to have an effect upon the localized regions responsible for the decameter bursts, it does not influence the over-all structure of the Jovian magnetosphere, which is responsible for the nonthermal emission at centimeter wavelengths.

The Physics and Chemistry of Interstellar Grains. I. Crystal Growth in Space. BERTRAM DONN, *Goddard Space Flight Center, NASA*.—Experimental and theoretical developments since about 1945 in (1) nucleation of condensing vapors, (2) mechanism of crystal growth, (3) chemical reactions at low temperatures including surface reactions of free radicals, and (4) radiation chemistry of solids,