Dieter, Nannielou H. *Neutral hydrogen in OB associations.*

Analysis of the line profiles of the neutral hydrogen survey of the galactic plane published by Muller and Westerhout has shown many cases in which neutral hydrogen appears within OB associations. Intensity contour diagrams of regions including such associations have been constructed from the line profiles for different velocities. In Morgan's unpublished catalogue of OB associations 31 are listed which occur within the limits of the Leiden survey, and for 25 of these some measure of the radial velocity is available from optical observations. For 20 of these associations a well-defined maximum in the equal-intensity contour diagrams occurs at the velocity of the association and does not occur at other similar velocities. For the remaining six associations a maximum occurs at a particular velocity, but no identification of the gas with the association can be made without stellar radial velocity measurements.

The distance of a hydrogen cloud may be estimated from the distance of the association and from its velocity and a model of galactic rotation. Comparison of the distances from the two methods shows many large discrepancies.

The contour diagrams show that the maximum in the equal-intensity contours changes its longitude continuously in one direction as the velocity changes. In each of the twelve cases in which it is possible to follow the maximum through such a progression this direction is consistent with the effect of the shearing action of galactic rotation.

Geophysics Research Directorate
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Bedford, Mass.

Drake, F. D. *A high-resolution radio study of the galactic center.*

A radio map covering five square degrees in the region of the galactic center has been made, using the 85-foot reflector of the National Radio Astronomy Observatory. A travelling-wave tube receiver operating at 8000 Mc/s was used, and the antenna beamwidth was about 7 minutes of arc. The map shows regions of radio emission apparently connected with the emission nebulosities observed optically in the vicinity of the galactic center. It is evident that these *H*II regions contribute only a very small amount of radio emission to the Sgr A source, and are not a part of the galactic nucleus. The nucleus itself consists of two bright regions of emission situated about 10 and 19 parsecs from the galactic center, and lying in the galactic plane, and two more distant regions at a distance of about 90 parsecs from the galactic center, situated symmetrically about the center and lying in the galactic plane. From the symmetry in the outer sources, it is suggested that they actually represent the projection of a ring of emission surrounding the galactic center.

Using the above described structure of the nucleus, previous observations of this region are reanalyzed so as to give flux density values for the four major emitting regions. It is found that the center two sources have thermal spectra, while the outer two have nonthermal spectra with spectral index 0.7. The inner two sources are interpreted to be *H*II regions. The brighter has a minimum emission measure of $5(10^5)$, a minimum electron density of 106 electrons/cm^3, and a maximum mass of $5(10^4)$ solar masses. The fainter has a maximum emission measure of $2(10^5)$, a minimum electron density of 58 electrons/cm^3, and a maximum mass of $6(10^4)$ solar masses.

Two models of the nucleus are proposed. In one, the "static nucleus" model, there are in the center about 10^9 solar masses of Population II stars in two small bodies similar to the nucleus of M31. The emitting gas is gas ejected from these stars, and the blue Population II stars excite the gas. A disk of neutral hydrogen rotates nearly as a solid body around this. In the second model, the "evolving nucleus" model, gas flows into the central parts of the nucleus, where massive young blue stars and the observed *H*II regions are formed. About one solar mass of *H*I per year flows out of the nucleus along a bar which terminates near the region of nonthermal emission. In both models the nonthermal emission is connected with magnetohydrodynamic effects associated with the galactic shear which commences in the region of the nonthermal emission. Both models are consistent with the present observations and the recent Leiden 21-cm observations of the region.

National Radio Astronomy Observatory
Greenbank, W. Va.

Drake, F. D. and Hvatum, S. *Non-thermal microwave radiation from Jupiter.*

Observations of the radio flux from Jupiter have been made at 22-cm and 68-cm wave lengths, using the NRAO 85-foot reflector. The mean flux observed at 22 cm was about $6(10^{-26})$ $(\text{wm}^{-2})\ m^{-2}(c/s)^{-1}$ during the month of May, 1959. The mean flux at 68 cm on May 26 and 27, 1959, was about $13(10^{-26})$ $(\text{wm}^{-2})\ m^{-2}(c/s)^{-1}$. The black-body disk temperatures required to produce the observed fluxes, 3000°K. and 70,000°K., approximately, are too high to be plausible. Flux measurements at 68 cm during the period July 20–30, 1959, have given a less certain flux density value of $5(10^{-26})$ $(\text{wm}^{-2})\ m^{-2}(c/s)^{-1}$. The observed fluxes are combined with the data of other observers to show that Jupiter is, in fact, emitting a non-thermal spectrum with flux proportional to $\lambda^{+.2}$, approximately.

An observational search for variations in the flux is discussed. High-sensitivity monitoring of the planet at 440 mc showed no statistically significant short period variations in flux during two nights of observing. An extensive set of observations at 22 cm suggests that variations of the order of 30 per cent occur in the flux in times of the order of days. There is no statistically significant correlation between the apparent variations and planetary rotation.

It is proposed that the radiation originates as synchrotron radiation from relativistic particles trapped in the Jovian magnetic field, a situation similar to the terrestrial Van Allen belts. A Jovian field of 5 gauss and a total number of particles 10^6 times greater than in the terrestrial system will suffice to explain the observations.

National Radio Astronomy Observatory
Green Bank, W. Va.

Edelson, S., Coates, R. J., Santini, N. and McCullough, T. F. *Time relations between centimeter wavelength bursts and solar Hα flares.*

Since March 1959 the Naval Research Laboratory has been making *Hα* spectroheliograms of the sun at 6-second intervals concomitantly with centimeter solar radio observations. Flare light-curves derived from these rapid-sequence films have been compared directly with the observed flux curves of the associated radio bursts. Current measurements of time differences between the *Hα* maximum intensity and the 10-cm peak flux indicate that the events may be classified according to the 10-cm excitation level which exists before the flux peak.

In the first type, the 10-cm radio flux rises rapidly to a peak from the quiet sun level in less than 2 minutes, and always precedes the *Hα* maxima. In 60 per cent of the events of this class, the 10-cm burst peaks occur 2 to 10 seconds before the *Hα* maxima; 35 per cent have time differences of 10 to 20 seconds; and 5 per cent lead the *Hα* by 20 to 30 seconds.

In the second type, 10-cm excitation exists for more than 4 minutes before the time of burst peak flux. Five per cent of the events of this class have 10-cm peaks following the *Hα* maxima by 0 to 10 seconds, while the great majority have 10-cm peaks preceding the flare maxima with the following time distribution: 30 per cent lead by 0 to 10 seconds, 35 per cent lead by 10 to 20 seconds, 25 per cent lead by 20 to 30 seconds, and 5 per cent lead by 30 to 40 seconds. There is evidence that several events of the second type may be associated with more than one source.

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Evans, John W. *Flare-associated magnetic activity in the sun.*

Observations of the longitudinal Zeeman effects in a solar active center show the variations of magnetic field strength during a period of 144 minutes on 30 April 1958, which included the development and decay of a flare of importance 1+. The measurements show that the flare crossed the neutral line of zero longitudinal field, and, although the extremities lay in regions of steep field gradients, most of the flare area was a region of low gradient. A small but pronounced S pole within the flare area developed and faded away in exact synchronism with the flare intensity. However, the large magnetic changes affected the whole field of the active center. The integrated magnetic energy of the region underwent a sharp decrease of about 16 per cent during the 14 minute rising phase of flare intensity, and an even sharper recovery to its initial value immediately after flare maximum. This behavior was shared by the large sunspot fields and the area outside the sunspots. On the assumption that the field was 5000 km deep, the energy change of the active center amounted to 4×10^{31} ergs. The *Hα* radiation of the flare during its life was about 10^{28} ergs. Thus the changes in magnetic energy probably exceed the total radiation of the flare in the Balmer and Lyman series by a considerable factor.

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