and which show little difference between the intensity and degree of polarization at 21 cm and the earlier results at 31 cm. Flat-helix electron distributions might be obtained from local acceleration and diffusion mechanisms which violate one or more of the adiabatic invariants of the particle motion. Support from the National Aeronautics and Space Administration during part of this project is acknowledged.

Neutrino Emission and a Possible Model for Pre-White Dwarf Stars. H. Y. CHIU, *Institute for Space Studies, and Department of Physics, Yale University*, P. MORRISON, *Nuclear Studies, Cornell University*, AND H. REEVES, *Department of Physics, University de Montréal*.—In previous work (Chiu and Morrison, *Phys. Rev. Letters* 5, 573, 1960; Chiu, *Astron. J.* 66, 40, 280, 1961) we have reported the importance of neutrino emission processes in old stars whose temperature is $>10^9$ °K. Work is also in progress to determine the properties of a dying star (pre-white dwarf star). Preliminary results indicate that for a star of small mass ($<1.4 M_{\odot}$), it is possible that the sequence of nuclear reactions leading eventually to the formation of iron (Burbidge, Burbidge, Fowler, and Hoyle, *Revs. Modern Phys.* 29, 547, 1957) may be broken somewhere before iron is formed, tentatively after helium burning but before carbon burning. This is because of the cooling effect of neutrino emission. The heating of a contracting core in the internuclear reaction contraction phase is suppressed.

Study of a Long-Lived Coronal Region near the Solar Pole. R. H. COOPER AND D. E. BILLINGS, *High Altitude Observatory, Boulder, Colorado*.—A bright $\lambda 5303$ emission feature in the solar corona, 25° from the N pole, persisted for over two years. J. L. Leroy (*Ann. D'Astrophys.* 23, 567, 1960) observed the feature during the autumn of 1959 in both $\lambda 5303$ and white light. By combining $\lambda 5303$ intensities from several coronagraph stations at 20° , 25° , and 30° from the pole we have been able to detect the feature from March 1959 to April 1961, which may be a record for longevity of a single solar feature. From east limb passages of the region we have computed a rotation period of 28.8 ± 0.3 synodic days; and from the west limb passages, 28.9 ± 0.4 days, the probable errors being checked both internally and externally. These periods compare favorably with 28.2 and 29.0 days given by equations of D'Azambuja [Goldberg, L., *The Sun*, edited by G. P. Kuiper (University of Chicago Press, Chicago, 1953)], which are respectively linear and quadratic in $\sin^2 \alpha$, and are based on filament observations. This study was carried out under the auspices of the Office of Naval Research.

Effects of Bound-Bound Absorption on Stellar Opacities. ARTHUR N. COX AND JOHN N. STEWART, *Los Alamos Scientific Laboratory*.—Monochromatic absorption coefficients and opacities have been calculated at essentially all conditions in stellar interiors and atmospheres for a mixture $X=0.744$, $Y=0.236$, and $Z=0.02$ (respectively, the mass fractions of hydrogen, helium, and the heavy elements—carbon, nitrogen, oxygen, neon, aluminum, silicon, and iron). The results available for 108 temperature and density points include the important mechanisms: bound-free absorption, free-free absorption, electron (Thomson or Compton) scattering, negative hydrogen ion absorption, and bound-bound absorption. Electron conduction is also considered, and the resulting effective, or total, opacity is given. The only nontrivial process which has been neglected is molecular absorption, important only at the very lowest temperatures in this tabulation.

The bound-bound (line) absorption is calculated by tabulating each important line and applying line-broadening formulas (Moszkowski, S. A. and Meyerott, R. E., Argonne National Laboratory Rept. ANL-4743, 1951, and H. R. Griem, *Astrophys. J.* 132, 883, 1960) and oscillator strengths (Green, L. C., et al., *Astrophys. J. Suppl.* 3, 37, 1957) to give the monochromatic absorption. The increase of the line opacity over the continuous opacity sometimes gets larger than a factor of three. The effects of the lines on the opacities are shown as contours with constant factor of line opacity to continuous opacity, on the temperature-density plane.

Rotation and Mass of the Magellanic-Type Galaxy NGC 4631. GERARD DE VAUCOULEURS AND ANTOINETTE DE VAUCOULEURS, *McDonald Observatory, University of Texas*.—A rotation curve of the edgewise Magellanic-type galaxy NGC 4631 was derived from five long-exposure spectrograms taken in April 1961 with the B-spectrograph at the prime focus of the 82-inch reflector. Measurements were made in 395 points of $H\alpha$ and six other emission lines at intervals of $50\mu=7''.45$ extending over a total length of $10'$ along the major axis of the object. The velocity range is from $+530 \text{ km sec}^{-1}$ about $6'$ west to $+740 \text{ km sec}^{-1}$ about $4'$ east of the center; the adopted mean rotational velocities are $V_r=57 \text{ km sec}^{-1}$ at $r=2'.0$ and $V_r=97 \text{ km sec}^{-1}$ at $r=4'.0$. If the distance is $\Delta=4.4 \text{ Mpc}$ (*Astrophys. J. Suppl.* No. 48, 270, 1961), these velocities give for the total mass of a model made up of two inhomogeneous spheroids (*Astrophys. J.* 131, 265, 1960) of radii $5'$ and $10'$ and axis ratio $c/a=0.2$, $M=(2.4 \pm 0.4) \times 10^{10}$ solar masses; the central density is $\rho_c=5.5 \times 10^{-24} \text{ g cm}^{-3}$ and the mean density $\langle \rho \rangle \approx 1.0 \times 10^{-24} \text{ g cm}^{-3}$. With the total magnitude $m_T=9.7$ (pg) measured by Holm-