and escape of neutrinos by the photoneutrino, pair annihilation, and plasma neutrino mechanisms.

The neutrino energy loss results in a phase of rapid collapse ($\sim 5 \times 10^3$ yr) when the neutrino and optical luminosities as well as the effective temperatures are high ($L \sim 10^3 L_\odot$, $L_\nu \sim 10^2 L$, $\log T_{\text{eff}} \sim 5$).

A comparison with recent work by Harmon and Seaton (*Astrophys. J.* **140**, 824, 1964) suggests the identification of these tracks with their proposed evolution for the nuclei of planetary nebula. This might be used as an argument for the reality of the theory of a universal weak interaction (Feynmann and Gell-Mann, *Phys. Rev.* **109**, 193, 1958; Sudarshan and Marshak, *Phys. Rev.* **109**, 1960, 1958) responsible for the above neutrino reactions.

The Solar Rotation Rate, Sunspot Development, and the General Circulation of the Solar Atmosphere. FREDERICK W. WARD, JR., *Air Force Cambridge Research Laboratories*.—The analysis of daily sunspot group proper motions for the 50-yr period 1905–1954 reveals three fundamental features of the horizontal wind field in the sunspot layer of the solar atmosphere. The large-scale or general circulation is fundamentally of a non-axisymmetric type with significant longitudinal and temporal changes. The time and/or space eddy wind field transports angular momentum equatorward in both hemispheres at a rate equal to 2% per day of the excess angular momentum in equatorial regions on the average. This process therefore appears to be the fundamental mechanism whereby the “equatorial acceleration” is maintained.

The average east–west motion, or rotation rate, is shown to be an inverse function of spot size. On the basis of some theoretical arguments, verified by data from the terrestrial atmosphere, it seems reasonable to assume the value derived from the smallest identifiable features to be the correct estimate of mass motions. On this basis, the solar rotation rate should be revised upward by 1–2% at all latitudes between 0–35°.

The east–west proper motion of sunspot groups decreases as the group develops in area. A similar situation exists for cyclonic storms in the terrestrial atmosphere and is a fundamental part of the energy exchange picture of the general circulation. It appears reasonable to assume a similar situation exists in the solar atmosphere.

Absorption Spectrum of Fe I in the Vacuum Ultraviolet. DOROTHY W. WEEKS, *Harvard College Observatory*.—Absorption spectrograms of Fe I in the region 2428 to 1650 Å in the temperature range 1500° to 2500° C were obtained by using the carbon-

tube furnace. Likewise, absorption spectrograms of Fe I in the region 1998 to 1460 Å were obtained by using the shock tube. Forty-three known lines of Fe I were used as standards between 2000 to 1855 Å, and for the shorter wavelengths on the furnace plate 16 predicted lines of Fe I and six Fe II lines were separately used as wavelength standards. From an analysis of the 300 spectral lines in the region 1998 Å to 1750 common to both spectrograms it appears that 21 new odd energy levels have been found, representing 269 lines, 88 lines previously observed in the laboratory and 181 lines observed in the solar spectrum 54 of which had not been identified.

Interstellar Lines and the Dissipation of Interstellar Magnetic Fields by Petschek's Mechanism. DONAT G. WENTZEL, *The University of Michigan*.—An efficient method of dissipating magnetic fields has been proposed by Petschek (*The Physics of Solar Flares*, NASA SP-50, p. 425, 1964). If such dissipation occurs within an interstellar cloud which radiates efficiently, it generates a thin layer of gas with a density of roughly 100 atoms/cm³ and a streaming speed of ± 3 km/sec. This *inhomogeneity* appears in 21-cm emission as a symmetrical pattern in the sky or as a Doppler profile with several, probably three, resolvable components. It is more visible in 21-cm absorption because the dense layers are cooled efficiently. The inhomogeneity may actually dominate the absorption lines of Ca⁺ and Na⁺, the abundances of which are proportional to the density. Observed ratios of line strengths (Howard, Wentzel, and McGee, *Astrophys. J.* **138**, 988, 1963) can be made consistent with a uniform abundance of free Ca and Na in low-velocity clouds; the underabundances relative to the sun become a factor 300 for Ca, 6 for Na.

In analogy to the geomagnetic field, Petschek's mechanism may disconnect interstellar H I clouds from the general galactic field. If so, clouds move independently of each other and of the galactic field; consequently spiral arms must be gravitational in origin and the galactic field, constrained only by negligible intercloud mass, must be nearly force-free. An elongation of the clouds along the confining galactic field can explain the alignment of interstellar polarization. The *evolution* of clouds may consist of their formation near a supernova, dissipation of internal magnetic fields and a compensating increase in density during some 10^8 yr, and finally star formation or simply disintegration.

Mapping the Brightness–Temperature Distribution of Jupiter at 10 μ . ROBERT L. WILDEY, *Mount Wilson and Palomar Observatories; Division*