the direction of the interstellar magnetic field in the vicinity of the sun can be derived with high accuracy from the interstellar polarization, it seems to be very difficult to obtain the direction of the local spiral arm accurately enough to determine this angle in our galaxy.

In extragalactic systems which are seen "pole on," the direction of the spiral arms can be readily determined. However, an attempt to derive the angle between the directions of the arms and the magnetic fields from published polarization data for spiral galaxies did not give conclusive results. Consequently new observations have been obtained with the 36-in. reflector of the McDonald Observatory. Significant polarization (between $p=0^{\circ}002$ and $p=0^{\circ}22$) was found in M51 and M81. The plane of vibration is, in general, parallel to the dust lanes in the spiral arms of these galaxies. There are indications, however, that radiation from the bright nuclei of these galaxies is scattered in the dust clouds of the spiral arms and contributes significantly to the observed polarized light.

Broadening of H and K Emission Cores and the Wilson-Bappu Effect. R. GRANT ATHAY AND A. SKUMANICH, *High Altitude Observatory*.—Widths of K_2 components W of H and K lines are investigated, assuming that they are formed in optically thick chromospheres with temperature increasing outward. The source $*$ function S is computed from an equation relating S to the Planck function B and the divergence of the line flux. At very large optical depths in the line $S \approx B$. Hence $S(\tau)$ mimics the minimum in $B(\tau)$ then rises with $B(\tau)$ in the chromosphere until the flux divergence forces $S(\tau)$ to decrease to $S(\tau_0) \ll B(\tau_0)$. The K_2 maximum results from the maximum in $S(\tau)$ and, for the sun, lies near the edge of the Doppler core.

W is investigated as a function of the following chromospheric parameters: line opacity τ_0^* , continuum opacity τ_c^* , electron density n_e^* , temperature T^* , Doppler width $\Delta\lambda_D^*$, and damping parameter a^* . W is particularly sensitive to τ_0^* , τ_c^* , a^* , and $\Delta\lambda_D^*$, but relatively insensitive to T^* and n_e^* . Changes in W resulting from τ_0^* , τ_c^* , and a^* arise from the displacement of K_2 between the Doppler core and line wings and are associated with major changes in the character of the profile. On the other hand, changes in $\Delta\lambda_D^*$ change W through a rather uniform scaling of the K_2 and K_3 profile without seriously affecting the location of K_2 relative to the Doppler core.

We interpret these results to mean that the Wilson-Bappu effect arises primarily from changes in $\Delta\lambda_D^*$, and, further, that there is a tendency among the chromospheres of all late-type stars to have approximately the same values of τ_c^* , τ_0^* , and

a^* . Increases in the K_2 intensity I_2 result from increases in T^* and/or increases in n_e^* , which leaves I_2 uncorrelated with W . To a first approximation, $I_2 \propto n_e^* B^*$ at $\tau_{5000} \approx 10^{-7}$.

Convection in Pulsating Stars: Quasi-Adiabatic Cepheid Models. N. H. BAKER, *Columbia University*, AND D. O. GOUGH, *Joint Institute for Laboratory Astrophysics*.—The time-dependent mixing-length theory described in the previous abstract has been applied, in the quasi-adiabatic approximation, to a series of models of δ Cephei stars of $7M_{\odot}$ previously studied by Baker and Kippenhahn (*Astrophys. J.* **142**, 868, 1965). The hottest models of this series have negligible surface convection zones, but the coolest models have deep convection zones that include the low-lying hydrogen and helium ionization regions. On the basis of the quasi-adiabatic approximation, which is not valid near the surface of our stellar envelopes, we tentatively conclude that the increasing importance of convection in stars of lower effective temperature is responsible for the return to stability at the cool edge of the Cepheid strip.

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The Origin of the Extragalactic Component of Cosmic Radiation in a Fib Model Universe. J. BARNOTHY AND M. FORRO, *Evanston, Illinois*.—Cosmic ray showers caused by protons of 10^{20} eV energy were observed by the Cornell, MIT, and Sidney groups, and there is no indication of an energy limit. Presently no mechanism is known which could accelerate particles to such energies. The idea that cosmological redshift and cosmic radiation have a common origin has been suggested by Erich Regener (*Naturwissenschaften*, 1931). In 1929 we built in the Eötvös Institute of the University of Budapest the first cosmic ray telescope and made a sky survey in search for discrete cosmic ray sources, but detected only the sidereal time periodicity predicted by Compton and Getting. Fifteen years of observation of this periodicity with different counter telescopes led us to the Fib theory of cosmic radiation (*Cisllagászati Lapok* **7**, 65, 1944).

The universe contains two populations, the elementary particles (forming the substratum) and the fields acting between them, represented by the messengers (photons, neutrinos, gravitons). At the moment of emission the messengers obtain their characteristic units, the message to be transmitted, from the substratum; but thereafter their characteristic units drift relative to the unit frame of the substratum. The metric of the Fib model universe