ABSTRACTS OF PAPERS FROM OTHER JOURNALS


Models of solar convection zones are constructed with the purpose of examining the effects of the change in three parameters appearing as numerical coefficients in Vitense’s mixing length theory, for which previous investigators assumed various different values each on rather arbitrary basis. These three are: (i) the efficiency factor in the expression for the convective energy flux, (ii) the factor representing the viscous braking effect in determining the velocity of the convective elements, and (iii) the factor in the expression of the super-adiabaticity in the convective element in connection with radiative effect.

Computations for various combinations of these parameter values are performed both with the assumption that the mixing length is equal to the density scale-height all over the range (case 1), and with an alternative assumption as proposed by Böhm and Stückl that the mixing length is shortened near both upper and lower boundaries (case 2). It is indicated as the result that the structure of the convection zone depends rather critically on the values of these three parameters, as well as on the assumption of the functional form for the mixing length near the boundaries.

Y. Uchida


A mechanism is proposed for the origin of solar chromospheric spicules in connection with the distribution of magnetic polarities outside active regions reported by Bappu et al. (1968). Their result suggests that there occur magnetically neutral regions (lines) along the boundaries of such polarity-cells all over the solar disk with a considerable surface density. These necessarily fall on some portion of the supergranulation boundaries since the magnetic field outside active regions is concentrated on the supergranulation boundaries irrespective of polarities, and thus we may expect a number of magnetically neutral regions imbedded along the supergranulation boundaries on which the field lines are compressed in the photospheric level and expanded in the corona with a strong gradient with height. The time scale of the magnetic field annihilation and reconnection in these neutral regions is estimated to be short enough if, for example, Petschek’s mechanism works there. The plasma bubbles with magnetic lines of force thus disconnected from their root in the photosphere, when a further compression is exerted for example by atmospheric oscillation, are expelled upwards in such a gradient due to the ‘melon seed effect’. The motion of the train of such bubbles, or a jet, is treated and it is shown that the flow has a subsonic-supersonic transition point (de Laval point) at around 2000 km and reaches a final velocity of 30 ~ 50 km/sec at height of 5000 ~ 10 000 km, and that a reasonable density distribution along the jet is obtained, for reasonable assumption of the physical condition on the supergranulation boundary.

Y. Uchida


Spectrograms of faculae were examined in the lines Hα, Hβ, H and K. With the assumption of a linear dependence of the line source function on optical depth the residual intensities yielded excitation temperatures 4330K (Hα), 4580K (Hβ), and 4850K (H and K) within the faculae compared with 4000K, 4300K, and 3900K in undisturbed regions of the chromosphere.

The Doppler-widths of Hα and Hβ were determined by means of a modification of Goldberg’s
multiplep method (the assumption of source-function equality of the multiplet is replaced by the assumption of equal excitation temperature). The Doppler-width of the central absorptions of the H and K lines were simply assumed to be proportional to their half-widths. The combination of the Doppler-widths of H and K yielded the kinetic temperatures 13900 K and 9740 K and the turbulent velocities 6.5 km/sec and 6.4 km/sec in faculae and undisturbed regions, resp.

Heights of the features were determined from the limb shift of the emission cores of the lines H and K. They range within 1500 and 3500 km. Under simplified assumptions, the variation of heights of the line from the distance of the limb centre of one convenient facula was used to derive the distribution of density with height. The result suggests that the density in faculae is by a factor 10 to 10^3 higher than in undisturbed regions.

E. A. GUSSMANN


Absolute fluxes of 9 spectral lines in the Extreme Ultraviolet part of the solar spectrum measured during 15 rocket flights in the period between August 1961 and November 1968 are presented. The lines are emitted by the following ions: H I, He I, He II, C III, O V, O VI, Mg X, Fe XV and Fe XVI. The Fe-lines exhibit a clear solar-cycle variation of a factor of about 6; the corresponding change in the 10.7 cm radio flux is a factor of 3. The variation in the fluxes of the other lines, which are of chromospheric origin, is far less; a change of 1.5 for a factor of 2 increase in the 10.7-cm flux.

L. D. de FEITER


The solar X-ray flux in the range 2 to 12 Å, as measured with Geiger counters on board Injuns 1 and 3, and Explorers 33 and 35, shows a long-term variation of at least a factor of 5 between 1961 and 1969. A slowly varying component that tracks the 10-cm radio flux is observed in the X-ray data; it is related to the appearance of major active regions on the solar disk. This variation, of a factor of 10, correlates well with variations of the radio flux at frequencies greater than about 1 GHz and far less at frequencies below 1 GHz.

Similar observations were done on board the Mariner 5 spacecraft; here the wavelength region is 2–9 Å. Comparison of the flux in the 2–9 Å region with that in the 2–12 Å region shows that the spectrum hardens during periods of high solar activity and may harden during flares, but it does not soften.

L. D. de FEITER


Detailed soft X-ray (2–12 Å) measurements on board Explorers 33 and 35 are presented for the 3B flare of July 8, 1707 UT, 1968. A comparison with 15375 MHz radio observations shows that this event provides an especially clear example of the general association of the X-ray and cm flare and of the lack of detailed similarity; the two types of emission begin simultaneously, but the radio emission peaks sooner, decays more rapidly and exhibit much more detailed character.

L. D. de FEITER


A spark chamber for the detection of recoil protons produced by neutrons in a 3 cm thick polyethylene slab has been flown on a balloon on July 28, 1967 at an atmospheric depth of 7 g/cm². During the
flight two importance 1 flares occurred. From the observations upper limits of the neutron fluxes for these flares can be set at \(1.0 \times 10^{-8}\) and \(1.7 \times 10^{-2}\) neutrons/cm\(^2\) sec, for neutron energies of 10 to 100 MeV.

L. D. de Feiter


The flash spectrum taken by using the jumping-film method at the total solar eclipse of February 5, 1962 (Lae, New Guinea) is analyzed for 130 emission lines between \(\lambda 5850\) and \(\lambda 6563\) Å at nineteen selected positions on the solar limb. An extensive table of measured logarithmic integrated intensities of these flash lines are given for some of the selected positions including a well-developed active region on the west limb, the photometric studies of which have already been published by several other authors. A particular attention is paid to the \(H_{\alpha}\) and D3 lines and the height variations of the intensities are studied for these two lines. It is revealed as the result that the gradients for both lines are small and the stronger intensities prevail above the active regions except above the right center of the spot itself where the gradients are larger and the intensities are smaller than those in the undisturbed regions.

Y. Uchida


The corona was photographed during the total solar eclipse of 1961 February 15 with a quadruple camera. Six plates were obtained (three in the blue and three in the red spectral region) each with four corona images, three through polaroids and one without polaroid. The photometry provided the intensities, the excess of red intensity to blue intensity, the amount and direction of polarization of the total corona. These data allow the separation of K- and F-coronas and the calculation of the electron densities. The results lead to an oblateness of the F-corona or to the assumption that the F-corona is polarized. The reason may be a partial alignment of the interplanetary dust particles.

The intensity of the F-corona and the excess of red to blue intensity was computed theoretically by the aid of the Fraunhofer-Airy theory of the diffraction of light. These results were compared with the observations. We obtain \(10^{-1}\) to \(5 \times 10^{-2}\) cm as an upper limit for the radii of the particles. No dependence of the distribution of the particles with increasing distance from the sun was found. (Author’s abstract.)

E. A. Gußmann


On photographs taken at the total solar eclipse of 1961 February 15 intensity, degree and direction of polarization, and the electron density were determined within and in the undisturbed neighbourhood of a coronal ray. These quantities are enlarged in the coronal ray, the electron density by a factor 3.

Measurements of the directions of the northern polar rays point out that the magnetic and rotational poles coincide. The shape of the polar rays cannot be represented by a magnetic dipole field or other fields with simple structure.

E. A. Gußmann


The high frequency cutoff of synchrotron radiation resulting from electrons with an anisotropic pitch...
angle distribution is investigated. It is shown that this effect could be responsible for the high frequency cutoffs of Type IV bursts at decimeter, meter and decameter wavelengths.

J.-C. HENOUX


Measurements of the interplanetary magnetic field between the orbits of the Earth and Mars, obtained with Mariner 4 over the period from November 28, 1964 to July 14, 1965, are used to study the radial dependence of the field. For the strength of the quiet-day field the best-fit power-law function of heliocentric radius $r$ was $B = (r/r_0)^{-1.25}$, where $1.0 \text{ AU} < r < 1.5 \text{ AU}$, $r_0 = 1.0 \text{ AU}$ and the units are $10^{-5}$ Gauss. Over this range of $r$ the power-law approximation for the strength of an ideal spiral field in a solar wind of 350-km/sec velocity is proportional to $(r/r_0)^{-1.29}$. The mean absolute values of the separate vector components did not exhibit the spiral-field behaviour.

The fluctuations transverse to the mean vector field were divided into a component in the spiral-field plane and one normal to this plane. The r.m.s. amplitude of these components varied according to $1.46 (r/r_0)^{-1.25}$ and $2.11 (r/r_0)^{-1.44}$ respectively. The r.m.s. amplitude of the parallel component varied as $1.35 (r/r_0)^{-0.54}$. Thus the relative amplitude of the parallel or compressional fluctuations grew as $r^{0.48}$. Extrapolation of this relation yields $\Delta B/B = 1$ at $r = 4.3 \text{ AU}$. These results apply to fluctuations in the frequency range from $10^{-5}$ to $10^{-2}$ Hz.

The estimated radial dependences indicate that an appreciable part of the observed fluctuations was produced by dynamical processes in the solar-wind plasma; the fluctuations are not produced by quasi-static irregularities frozen into the solar wind. The amplitudes of the fluctuations suggest that non-linear processes are important in their production.

L. D. DE FEITER


The direction of the solar wind has been determined from an analysis of the data obtained with the MIT Faraday cup on the IMP I satellite. During the period November 27, 1963, to February 24, 1964, the solar wind was, on the average, in the ecliptic plane (50% of the cases between $-2^\circ$ and $+2^\circ$) and came from west of the sun in 72% of the cases; the average value of the ecliptic longitude was $-1.5^\circ$. If a systematic error of $1^\circ$ is allowed, the above figures become 56% and 86% in the two extreme cases.

L. D. DE FEITER


Annual means of the diurnal anisotropy from 1937 to 1967 are shown to result from the addition of two distinct diurnal components. One component, with maximum in the asymptotic direction 128° east of the sun, contains a well-determined wave, $W$, with a period of two solar cycles. $W$ passed through zero in 1958 when the sun’s poloidal field reversed. The remaining component with $W$ eliminated, has its maximum in the asymptotic direction 90° east of the sun. Annual means of this component, with maximum at 18.0 hours local asymptotic time, are well correlated $(r = +0.75)$ with magnetic activity and determine a solar cycle variation with minimum near sunspot minimum and amplitude about two-thirds that of $W$. These results derive from a statistical investigation of the variability of annual means of the diurnal variation from ion-chamber data at Cheltenham-Fredericksburg, Huancayao, and Christchurch.

Note: K. H. Schatten and J. M. Wilcox, J. Geophys. Res. 74, (1969), 4157 interpret the wave $W$ in terms of enhanced magnetic reconnection between the nearby galactic field and the field lines in the polar regions of the heliosphere during one-half of the 20-year solar magnetic cycle. This interpreta-
tion leads to the result that the component parallel to the solar rotation axis of the nearby galactic field is directed northward.

L. D. de Feiter


It is argued that the large electron-proton temperature ratio ($T_e/T_p \approx 800$ at 1 AU) predicted by the Hartle-Sturrock two-fluid solar wind model may be unstable to generation of ion-acoustic waves beyond 0.1 AU, and that this instability is capable of providing a turbulent mechanism for the preferential heating of protons to produce ratios $T_e/T_p \leq 5-10$, near 1 AU, in accord with experimental observations.

L. D. de Feiter


The propagation of flare-generated shock waves through the solar wind is examined using numerical solutions of the time-dependent hydrodynamic equations. These solutions are valid for all shock strengths, including the intermediate values that have been observed in the solar wind, and take into account the variation of the properties of the ambient solar wind. The entire range of time scales for energy deposition in the disturbance, from impulsive (producing "blast waves") to continuous deposition, is considered. For the former class of disturbances the solutions approach a limiting form dependent only on the total energy in the wave. Relationships among the energy, shock strength at 1 AU, and transit time to 1 AU are found in the blast wave limit. For disturbances with energies near $10^{21}$ ergs, the wave propagates from the sun to 1 AU in $\sim$ 60 hours, and is preceded by an intermediate strength shock at the latter distance. Both the transit time and shock strength are in good agreement with directly observed values.

L. D. de Feiter


For the May 28, 1967 solar-flare particle event spectra of protons in the energy range between 0.65 and 18.9 MeV, and of alphas between 4.05 and 45.9 MeV were obtained with a solid-state telescope on board Explorer 34 (IMP F). Whereas the higher energy particle fluxes, as determined from riometer- and neutron-monitor observations, exhibit "classical" west-limb flare profiles, the lower energy fluxes show characteristics of particle storage either at the sun or in interplanetary space. The high-energy fluxes can be fit both by a simple isotropic diffusion-with-boundary model as by a radial dependent scattering center model. The diffusion model of Jokipii is used with the result of a fit to the exponential decay of the event to predict an $f^{-3}$ dependence of the power spectral density of the interplanetary magnetic field fluctuations (assuming a boundary location independent of rigidity). The ratio of particle fluxes before and after a sudden, discontinuous flux decrease (attributed to a sector boundary) is found to be $R^8$ for protons and $R^6$ for alphas for particles with rigidities $\leq 200$ MeV. Significant velocity dispersions are discovered in three of the flux modulations during the onset stage of the event. The velocity dispersions in one of these modulations could be interpreted as due to a modulating region located $\sim 0.03$ AU from the earth. It is speculated that this region was responsible for an ssc at the earth some two hours later.

L. D. de Feiter


The interplanetary sector structure during the years 1966 and 1967 was often quasi-stationary for a
few rotations followed by an appreciable change in the next rotation. When a sector boundary passes the earth, geomagnetic activity tends to increase, an effect rather similar to that observed near sunspot minimum. The recurrence period of the interplanetary field during the interval investigated was 27.5 ± 0.1 days.

L. D. de Feiter


The causes of 19 worldwide changes in the earth’s magnetic field, occurring between June and December 1967, were determined by examining magnetic field and plasma data for the solar wind near the earth. Seven of the events were classified as storm sudden commencements (ssc), four as sudden impulses (si), and for the remaining 8 events no consensus existed between the observatories as to the classification. All of the ssc’s were caused by interplanetary hydromagnetic shocks. Two of the si’s were negative impulses (si—) and were caused by tangential discontinuities across which the density decreased. The other 2 si’s were distinct pulses in the magnetograms; they were caused by dense spots in the solar wind with dimensions of approximately 0.005 AU. Five of the unclassified events were caused by shocks and the other 3 by tangential discontinuities in the solar wind. There seems to be no unique way to predict, from the appearance on the magnetograms, the type of interplanetary structure which gave rise to the event.

L. D. de Feiter


The authors consider the problem of the time variation of the synchrotron flux density of relativistic electrons with an assumed power law spectrum and taking ionisation losses into account. The cases are considered that the generation region of this emission originally undergoes a homogeneous compression or an expansion. It is shown that in the case of the compression, the flux density at a given frequency increases proportionally to the value of the compression in the power law of the initial differential spectrum of the relativistic electrons. To a considerable extent, ionization losses decrease the flux density. In the case of expansion, on the contrary, the flux density rapidly decreases, depending on the degree of the expansion, ionization losses and the power index of the differential spectrum according to the same law as in the case of the compression. The results are applied to the explanation of the increasing and the decreasing parts of impulsive bursts. Bursts of the impulsive type are best described with the condition of small losses.

N. N. Stepanyan


The catalogue contains 622 bursts of the solar radiation recorded at the Crimean astrophysical observatory during the IGY and IQSY from July 1957 to December 1969. The bursts are shown as copies of original recordings of the general solar flux density.

N. Stepanyan


Observations of six CeII lines in the solar spectrum show that the lines reverse from absorption to emission on the disk, inside the limb. Furthermore, the position of this reversal varies with wavelength. Analysis implies that this behavior is due to the dominance of the scattering term in the line source.
function. The absorption-line profiles favor a non-thermal velocity field that is anisotropic. The emission-line profiles require a horizontal non-thermal velocity of $2.0 \pm 0.2 \text{ km sec}^{-1}$, averaged over heights $0 < \delta < 400 \text{ km}$. The equivalent widths and central intensities of the absorption lines require a certain abundance $\log N_{\text{O}} = 1.4 \pm 0.3$ ($\log N_{\text{H}} = 12.0$), and favor the Bilderberg temperature distribution over that of Holweger.

JAY M. PASACHOFF


Wavelengths are tabulated for 1987 features in the range of the solar spectrum 3650–3000 Å. These features come out of the detailed examination and intercomparison of several sets of high-dispersion photoelectric records from McMath-Hulbert and Mount Wilson and the Second Revised Rowland. 551 features are new, 557 features agree sufficiently in wavelength to confirm Second Revised Rowland features, and 237 are Second Revised Rowland features whose existence is called into question. Some equivalent widths are measured, and identifications proposed.

JAY M. PASACHOFF


The total solar eclipse of November 12, 1966 was observed with a photoelectric spectrometer. Limb-darkening curves are discussed for regions of the continuum 1.5 Å wide around 5278 and 6404 Å. On the disk, the surface-brightness results agree with those of previous investigations. But at the extreme limb, the curves continue to fall with decreasing scale height (as low as 50 km) to about 550 km (about 800 km above unity continuum optical depth). Here there is a sharp break in the curves, and the surface brightness falls very slowly for the next 1000 km. This break and plateau are not predicted by existing solar models. It is argued that hydrogen ionization must be negligible to explain the low scale heights, and hence that $T < 5000K$ out to 550 km; above, $T$ is probably greater than 6000K.

JAY M. PASACHOFF


Theoretical equivalent widths for solar [FeII] lines calculated with five photospheric models are compared with observed values. The mean abundance is $-4.37$ from the observed lines. This is $10^{0.19}$ smaller than the abundance previously derived from the theoretical widths, but is still an order of magnitude larger than that derived from permitted lines of Fe1 and FeII. Possible effects from deviations from LTE or from systematic errors in the absolute scales of oscillator strengths are discussed.

JAY M. PASACHOFF


Analysis of the spectra of strong radio echoes from the sun reveals a rapid rise in the velocity of the coronal plasma above plage regions. This velocity sometimes reaches 120 km/sec at a height of only $1.7 R_{\odot}$. On the assumption that the acceleration of the subsonic flow is determined by the heating caused by the dissipation of plasma turbulence, the rise of temperature and the input of energy in the region of the acceleration has been computed.

J.-C. HÉNOUX