XV GENERAL ASSEMBLY IAU SYDNEY 1973

COMMISSION 46 (Teaching of Astronomy)

RESOLUTION passed on 22 August

The IAU Commission 46 (Teaching of Astronomy) earnestly recommends that the appropriate authorities in the various adhering countries be requested to actively support the efforts of teachers endeavouring to introduce curricular developments in astronomy.

Moved: D. McNally
Seconded: Edith A. Müller

Report on the I.A.U. Symposium No. 56 on "Fine Structure of the Chromosphere"

The Symposium was held at Surfers' Paradise, Australia, between September 3-7, 1973, immediately after the I. A. U. General Assembly.

The review talks and the discussions following them, as well as the individual papers, were mostly centred around the spicules which form the most conspicuous fine structures of the solar chromosphere.

In his talk on spicules and their surroundings, Michard (paper presented by Rösch) summarised the physical properties of spicules like size, forms, opacity, number density, life-times and motions derived from studies of their spectra. The spicules are denser than their surroundings at all heights and are hotter than the surroundings below a certain level and cooler above this level. They cluster in "coarse mottles" outlining the coarse network. The spicule neighbourhood are thus regions of the chromosphere with enhanced emission in centres of many lines like H-alpha, K line, Lyman-alpha and XUV lines.

The upward acceleration of spicules by the radiation pressure resulting from Lyman-alpha absorption was considered by Athay. He suggested that, in the case of the sun, temperature and density inhomogeneities produce regions of enhanced radiation pressure. In the case of H-alpha, CaII and MgII, the radiation pressure is of little importance in the solar chromosphere, whereas, Lyman-alpha radiation pressure attains very significant values. The atmosphere which thus gets distended over its hydrostatic limit would be subject to instability. The marked variations in the radiation pressure in the different structures in the chromosphere like the network regions, the bright points etc. do have favourable values for ρ ($L\alpha$) to provide the observed upward ejection velocities for the spicules.

Ulrich-Grössman in his paper "On the design of chromospheric models" dealt with the comparison of the H-alpha line profiles of specific chromospheric features derived from high resolution spectra with theoretical predictions. The profiles computed using the velocity model of Athay, where in an atmosphere, the departures from the undisturbed state is assumed to be caused only by vertical mass motions, do not fit the observed profiles. According to the density mode each structure of the chromosphere can be assumed to consist of a cloud overlying an otherwise undisturbed atmosphere. On the basis of the cloud model Ulrich explained the existence of the bright and dark mottles seen in H-alpha spectroheliograms as due to the change in the value of the source function. According to him the computed profiles for structures at the supergranular boundaries agree well with the observed profiles. But the extension of this method leads to singly peaked profiles in the K line of CaII and is unable to explain the double emission peak structure, which is the most common form of the profile.

Giovanelli presented recent observations made at Culgoora showing the waves and oscillations in the chromosphere over sunspot regions. The time sequence filtergrams taken simultaneously at $\pm$ 0.25Å from the H-alpha line centre over sunspot near the solar disc centre, when photographically subtracted from one another show waves propagating outwards over the penumbra with velocities of 15 km sec^{-1} and periods around 210 sec. These waves are the same as those seen by Zirin and Stein in their Big Bear H-alpha movies, but their estimation of velocity is much lower, being that of sound waves. These penumbral waves were seen clearly in the movie screened. These waves ere transverse and Giovanelli interprets them as Alfven wave. He also finds that there is a close relation between umbral oscillations and penumbral waves, showing that a flux of energy flows out of the umbra across the penumbra. The explanation for the disappearance of these waves beyond the penumbral boundary is not known. In the quiet chromosphere the various observations give differing values for the periods of velocity oscillations at the centres of supergranules and their boundaries. We do not know whether these differences are really due to any lack of similarity in the structures constituting these regions on the solar surface.

The fine structure of chromospheric plages and their relation to the evolution of magnetic field, was discussed by Zirin based on the excellent observations collected at the Big Bear Observatory. The field initially appears at the chromospheric level in the form of arch filament systems (AFS). All active regions begin as an AFS which trace out the flux loops that have emerged recently through the solar surface, and connect regions of opposite polarity. The flow pattern in these arches are seen well in the excellent high resolution on-band and off-band H-alpha filtergrams of the Big Bear Observatory. They have rising motion at the centre, with material streaming down both ends. The initially low lying field of an arch comes out of the photosphere and spots form in the regions at the feet of the arches, with the plage in between. The brightness of the plage is an indication of the strength of the magnetic field, the brighter the plage, the greater the field strength. In comparison to these AFS, which represent active regions which are several days old and hence do not change much, are the emerging flux regions (EFR) which are compact areas of new bipolar magnetic flux. Many cases of spot development show that all new sunspot flux emerges in bipolar form as EFR. In a non-active region, the emerging flux regions occur in a random way at the rate of nearly one per day. In active regions the rate is much more, particularly during the early life of the spots. The flux regions come up in a random way in non-active regions, but appear on the site of old active regions. The form the new spot will take also depends on the remnant field in that region. This was illustrated by the fine movies Zirin showed, which included a movie on the development of a flare.

Dale Vrabec reviewed in detail the recent observations showing the migration of magnetic flux elements designated as moving magnetic features (MMF) in the vicinity of sunspots. When a spot has attained its maximum development, the magnetic fields adjacent to the outer periphery of the penumbra become fragmented and disperse over an annular region (named as the "moat" in the literature) with an extent of about 20,000 km from the outer edge of the penumbra. Time-lapse movies show that the fragments of fields in the "moat" radially move away from the sunspot. Vrabec termed these MMF as the "magnetic flux outflow" (MFO). The magnetic fields are "frozen" in the photospheric material and the MMF can be taken to map the streamlines of this velocity field. Harvey and Harvey from a study of the out flowing MMF suggest that the presence of a "moat" is a necessary condition for the occurrence of MMF. These MMF have velocities in the range of a tenth of a km to about 2 km sec^{-1}. Near the outer boundary of the moat, this movement becomes ill-defined abruptly.

MMF have a wide range of sizes, the most common being about 1500 km. Field measurement of individual MMF by Harvey and Harvey show a longitudinal field of 300 gauss. The main distinguishing character of the MMF from the non-spot magnetic field lies in their structural differences. The non-spot magnetic fields clump together to form aggregate blobs of different sizes. Similar blobs form the network. The MMF occuring in the moats tend to occur as single entities, representing the most elementary forms of the magnetic fields found on the solar surface. Another interesting aspect of the review was the discussion of the observations made at Kitt Peak which showed that the MFO is the agency responsible for the steady transfer of magnetic fields from a decaying spot, into the surrounding net work. Observations on two spots showed that the rate of transfer of the flux by the MFO was equal to the rate of decrease of flux in the spot. Similarly there are preliminary observations showing the existense of magnetic flux inflow, transferring magnetic elements into the umbra of a large spot during the early stages of its rapid growth.

One of the features on the solar surface that interested solar observers was the "filigree" described by Beckers. The bright features seen in the filtergrams obtained in the wings of H-alpha (at 2Å off band) constitute the filigree. These features are 4 sec of arc in size. They form a net work of the dimensions 1200 to 2700 km across. They occur on the boundaries of the granules, i.e. on the dark lanes of the granules. In quiet regions, changes in the geometry take place in 5-10 mins. How is the filigree related to the magnetic field and how does their brightness structure in other lines differ from that in H-alpha are questions awaiting answers.

By far the most important features in the upper chromosphere are the spicules. Although a lot of information has piled about their profiles, their dynamics, etc., some of the more fundamental problems, like their identity with disc features—dark and bright mottles —and the role they play in transporting energy to the corona remain still unanswered.

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Report on the I.A.U. Symposium No. 60

on "Galactic Radio Astronomy"

The symposium on Galactic Radio Astronomy was held at Maroochydore, north of Brisbane in Queensland between September 3-7, 1973. There were about 100 participants and the meetings were held in an isolated hotel on the Suncoast of Queensland.

The scientific programmes were organized in the form of 6 sessions covering the following topics : Interstellar Medium; 2) Galactic H II Regions; 3) Stellar and Circumstellar Sources; 4) Galactic Centre; 5) Large Scale Galactic Structure; and 6) Supernova Remnants. In each session, there were a number of invited papers, followed by a few contributed papers.

In the session on interstellar medium, Radhakrishnan summarised the evidence for an intercloud medium. He pointed out that there is accumulating evidence for two component structure of the interstellar medium consisting of cold dense concentrations with spin temperatures of tens of degrees embedded in a hot tenuous medium at several hundred degrees or more. Heiles presented the extremely interesting maps of the large scale distribution of neutral hydrogen obtained directly from the observed profiles without imposing a kinematic model of the galaxy. He emphasized that the maps do not substantiate many aspects of the theoretical interstellar cloud models. The maps reveal large coherent gas structures which are often filamentary in shape and aligned parallel to the interstellar magnetic field as determined from polarization of starlight. Even in small velocity ranges the maps show small scale filamentary structure with Doppler velocity gradients along their lengths. Güelin summarised the information on the density of free electrons outside H II regions, obtained from the study of emission of $H\alpha$, N II, radio recombination lines and from the dispersion measures of pulsars. He felt that the last method gave the most consistent values of about 0.03 electron per cm^{-3} for distances not too far from the Sun. Jenkins reviewed the new information on interstellar absorption lines in the ultraviolet obtained using the spectrographs on the Copernicus satellite. The number of atoms and ions which may be studied has increased from six in the visible to more than thirty. He pointed out that observations of the