7. Large-Scale Solar Motions (Dr H. Reh1)

The review began with a short description of several theoretical ideas to explain the solar differential, rotation and the problems connected with them. The main section of the review contained the observational aspects of large-scale solar motions. The well known motions of sunspots detected by tracer techniques were mentioned. The main result is that the plasma and the solar fine structures show different rotation velocities at the equator and that the amount of the differential rotation is also quite different. Almost no differential rotation was found for long lived magnetic features and coronal holes.

The motions of Ca$^+$-mottles of the quiet sun which have been studied since 1974 rather extensively by E. H. Schröter and the author at the Swiss station of the Göttingen Observatory were described in more detail. The most important result is the detection of a giant circulation cell pattern within the equator belt in early summer 1975. Several attempts to search for a similar giant circulation pattern of four antisymmetric cells crossing the equator in photospheric layers by using Doppler shift measurements were unsuccessful.

8. Variations in Solar Activity and Rotation (Dr J. Eddy)

Although the early part of the sunspot number curve is not well documented, the 17th century shows a major anomaly (the Maunder minimum) when no spots were observed on the N. hemisphere of the sun for 43 years and no spots at all for up to 10 years. The 11-year cycle was also absent, a fact that was a matter of contemporary concern. The rarity of aurorae, lack of eclipse sightings of the corona and C$^{14}$ data all agree in showing that this was a period of low activity.

Records of aurorae, coronal sightings and C$^{14}$ data go back to about 5000 B.C. and all show variations in activity. There was a maximum in about 1200 A.D. and there were at least 5 periods of essentially zero activity. There is however no sign of a long term periodicity.

Studies of sunspot drawings by Scheiner and Hevelius suggest that the rotation period of the sun was about 1 day shorter during the Maunder minimum than it was beforehand, when the rotation rate was essentially equal to the present-day rate.

27 August 1976

SCIENTIFIC MEETING

1. Solar Neutrinos (Dr H. J. Newman)

While work continues towards the development of alternative and independent techniques, observational evidence concerning the flux of neutrinos from the sun at present is offered only by the $^{37}Cl$ experiment of Raymond Davis and his collaborators at the Brookhaven National Laboratory. This is in a sense unfortunate, for the energy of the copious flux of neutrinos believed to be produced by the basic proton-proton reaction is below threshold for the $^{37}Cl$ detector, and the high-energy neutrinos from the PP II and PP III completions ($^7Be$ and $^8B$ decays) which produce the bulk of the counts on $^{37}Cl$ predicted by standard solar models can be quenched in a variety of ways. A definite test of the essential correctness of our understanding of solar structure and energy generation can only be provided by an experiment of increased sensitivity, and preferably one sensitive to the presence or absence of the low-energy neutrino flux.

Although the Brookhaven experiment is currently indicating a counting rate on $^{37}Cl$ of about $1.5 \pm 0.5$ SNU (one Solar Neutrino Unit = $10^{-36}$ capture per second per target atom) and standard solar models predict about $5 \pm 1.5$ SNU, the extreme