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Section 6. Solar Emission and Related Terrestrial Phenomena

Regular three-station observations of interplanetary scintillation (IPS) of radio sources for studying the solar wind have been continued at 69 MHz and 327 MHz. However, the dipole arrays at 69 MHz, which have been operated since 1971, have become obsolete, and we have to reconstruct them at three stations. The data-book of solar wind speeds from IPS measurements at 69 MHz for 1982 has been published.

The cylindrical parabolic antenna and the phased array at Toyokawa have been improved to reduce interference noises and increase the signal to noise ratio.

We are interested in the solar wind at high latitudes. We have attempted to derive the distribution of the solar wind velocity in heliographic longitude and latitude on the solar surface in early 1982. The polar high-speed region with a uniformly high (800 km/s) speed at all latitudes above 45 degrees, such as that inferred from VHF observations in 1974 - 1977, was not yet developed in the northern hemisphere, though high-speed streams were observed at high latitudes; while Kitt Peak He 10830A observations (Solar-Geophysical Data, 454 Part I, 37, June 1982, U.S. Department of Commerce (Boulder, Colorado, U.S.A. 80303)) show that the polar coronal hole extended down to 60 - 70 degrees latitude.

The directional properties of the propagations of three flare-associated interplanetary disturbances in February 1979 were studied on the basis of the solar wind data obtained by the IPS technique. These disturbances were associated with intense solar flares which occurred within the McMath plage region No. 15380 at the heliolongitudes of E59, E13, and W15 on Feb. 16, 18, and 20, 1979 respectively. It is found that the directional velocity distributions of these flare-associated disturbances near 1 AU were distorted by the ambient solar wind stream structure.

The directional properties of the interplanetary shock wave disturbance relating to the very severe geomagnetic storm of August

27-29, 1978 is being investigated on the basis of the IPS observations. The solar source of the disturbance is identified as the disappearing solar filament which occurred as N15E03 at 11 ± 3 UT on August 23, 1978. The principal portion of this disturbance propagated with small deceleration out to 1 AU. The extent of high-speed portion (~ 500 km/s) of the disturbance was about 50 degrees in the longitudinal direction, and the latitudinal extent was less than 40 degrees near 1 AU. Approximate mass and total energy of the disturbance near 1 AU are estimated to have been about 10^{16} g and 10^{31} erg, respectively. These values are comparable to those of flare-generated interplanetary disturbances at 1 AU. Outstanding increase of turbulent level of post-shock plasma was observed in the region of the interplanetary space to the east of the normal of the eruption. Transient high-speed stream was observed after the passage of the shock wave disturbance for 1-2 days.

The conditions for steady solar winds have been studied. By use of the computer-simulation method, it has been found that a nonsteady solar wind with an arbitrary velocity distribution in interplanetary space develops to form the steady solar wind if the plasma pressure at the outer boundary is small enough; all velocity differences between the initial distribution and the steady distribution, which are treated as coronal disturbances, propagate out of the system in a finite time.

The computer analyses for the cylindrically symmetric structure of the solar wind have been continued. A stationary structure of $42 R_{\odot} \times 42 R_{\odot}$ including solar rotational effect has been obtained. In our analyses the coronal pressure and the solar gravity have been considered as the basic forces which act the solar wind. But an additional force for the solar wind acceleration is necessary to explain the observations of high-speed solar winds. The computer-studies of the additional acceleration effect due to MHD waves are under consideration. The studies of the two-dimensional dynamics for coronal disturbances have also been started.

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Publications

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