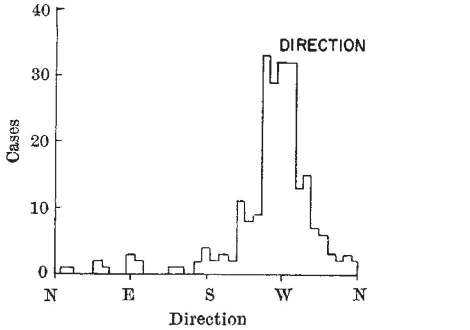

Fig. 2. Direction distribution of sporadic-E patches observed on high-frequency backscatter equipment

defined as the mean range and the mean angular position in azimuth, was plotted until the patch either moved out of range or was otherwise lost. A total of some 264 such tracks were studied and speed and direction information derived.

These results are shown in Figs. 1 and 2. The speed distribution has a peak at 250 km./hr.; but a few very high-speed cases raise the mean value to 300 km./hr. In only nine cases out of 264 were speeds greater than 550 km./hr. recorded. Direction is predominantly toward the west, and in 80 per cent of the cases it was within 45° due west. It is interesting to note that the mean speed is approximately one-fourth of the speed of the subsolar point at this latitude, and the average direction of patch motion is the same as that of the subsolar point.

Apparent speed of drift of these patches is in good agreement with that of ionospheric winds, as determined by the meteor trail drift method[7-9], and of E_s motion, as measured by the fading method[6,10]. However, the predominant direction of motion of the sporadic-E patches in this study does not agree with the predominant directions of motions determined by the other methods. Moreover, the present work brought to light no diurnal changes in the direction of apparent motion as have previously been reported.

Ferrell and Gerson have previously deduced sporadic-E cloud drift by a method somewhat analogous to the present one, utilizing radio amateur transmissions in the 50-Mc./s. band[4,5]. While the speeds which they reported were in rough agreement with those of the present study, the directions reported were variable and showed no particular tendency to favour the west. The number of patches observed in this study is far larger than the number reported by Ferrell and Gerson.

Supporting evidence for the reality of the patch position and time measurement was obtained with the aid of the C-3 vertical incidence ionospheric sounder at Stanford University. Forty-one of the tracks plotted had directions which carried them directly overhead at Stanford. From the trails, predictions of arrival time overhead were made and verified by searching for a peak in the sporadic-E penetration frequency, as indicated on the vertical sounder records for the predicted time. The agreement was close in 90 per cent of the cases. In only two cases did the patch fail to appear overhead. In both these instances the patches were receding from the sounder and extrapolation backwards in time was required. These patches, accordingly, may have been formed at times later than their calculated time of appearance overhead.

Further details will be found in a paper now being prepared for publication.

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High-Energy Particles in Solar Flares

AT a recent lecture delivered at Harwell, Dr. I. V. Kurchatov gave details of Russian experiments with high current-density gas discharges. One interesting phenomenon that was observed concerned the production of high-energy particles in the discharge, possessing energies greatly in excess of those that could be attributed to the Maxwellian distribution at the temperatures reached in the spark, and also greatly in excess of the electron-energy corresponding to the potential difference across the spark gap. This effect could be observed in deuterium through the production of neutrons and gamma-rays. The onset of this phenomenon was always clearly related to a certain behaviour of the spark, namely, to the second constriction that occurred. It must therefore be supposed that in the complicated electrodynamical processes that occur in sparks that become constricted in their own magnetic field, there occurs a mechanism for accelerating a small fraction of the particles to high energies. This can perhaps be understood in terms of multiple reflexions of ions in the interior of a rapidly converging cylindrical magnetic shock wave.

The interpretation of solar flares is not yet clear. The effect could well be interpreted as an electrical discharge; but in a gas already highly ionized before the discharge, it is necessary to find a reason for the sudden onset of the phenomenon. It could be that electric currents evenly distributed through large volumes normally flow in the vicinity of changing sunspots; but that in circumstances when the current density exceeds a certain value, an instability occurs causing the currents to become constricted along one or several lines due to their own magnetic fields (the 'pinch' effect).

High-energy particles are produced in solar flares, as is clear from certain radio observations and from the occurrence of associated cosmic-ray effects. If the interpretation of a flare given here is correct, the Russian experiments would seem to provide a laboratory analogy for this effect which will greatly facilitate further analysis.

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