prominences and the faculæ. These observations, there­fore, establish not only an important connexion between spots, metallic prominences, and faculæ but also the fact of the wonderful localization of these phenomena upon the sun. The spots are never seen higher in latitude than 40° north or south, and they are invariably seen in smaller quantity at the equator. Similarly, the faculæ and metal­lic prominences do not go much beyond 40° north or south, and their minima are also at the equator. But this does not hold good for prominences of the quiet sort and the veiled spots,—that is, spots without umbræ or very highly developed penumbræ. They extend from one pole of the sun to the other ; hence there must exist a great difference between metallic and quiet prominences and between dis­turbed and veiled spots.

Although the more important of these solar phenomena are limited to certain zones of the sun’s surface, and al­though they vary very violently, they have a cycle or regular succession of changes, during which the particular zone of the sun on which they appear alters. When there is the smallest number of spots on the sun—that is to say, when there is a sun-spot minimum—the spots that appear are seen in a high latitude, and the latitude decreases gradually until we arrive at the next minimum. Thus there are two perfectly distinct spotted areas, one corre­sponding to the end of the old period, the other to the beginning of the new period. At the maximum period of sun spots the latitude of the spot zone is about 15°. Activity in the solar atmosphere, therefore, appears to begin in a high latitude—say about 30° or 35°—and very soon reaches the maximum in about latitude 15°; then it gradually dies away until spots, metallic prominences, and faculæ—all of reduced intensity—cling pretty near to the solar equator, and at the same time we get a new wave of activity, beginning again in a high latitude. This asso­ciation of what may be called localized phenomena is quite in harmony with a similar association of phenomena which are more or less generally distributed over the whole sur­face of the sun.

Pores, which are in reality nothing but small sun spots, may occur in any part of the sun, and are always accom­panied by a slight waviness in the chromosphere. Veiled spots—spots which never attain full development—are also universally distributed over the sun’s surface and are accompanied by small prominences (see below).

The main periodicity on the sun is that of about eleven years which elapses between two successive maxima or minima. When the sun is quietest, there are very few of the ordinary tree-like prominences visible, and there is an especial dearth of them near the poles and the equator. There are faculæ, but they do not present their usual bright appearance, and are confined to the regions between latitudes 20° N. and 20° S. On examining the chemical nature of the materials in the chromosphere at such a period by means of a spectroscope, we see only the four lines of hydrogen and the line D3, whose chemical signifi­cance we do not know. Practically speaking, there are no spots visible and the disk appears to be perfectly pure, except the darkening towards the limb produced by absorption in the sun’s atmosphere. As there are no spots, or only very small ones in high latitudes, it follows that there are no metallic prominences. The spectroscope searching right round the limb of the sun gathers no indications of violent action—no region giving many lines —nothing but the simple spectrum of hydrogen. Obser­vations and photographs of the corona taken at solar eclipses occurring at minimum spot periods indicate that at two different sun-spot minima the appearances pre­sented by the corona are very much alike. A drawing made during the eclipse of 1867, before the application of

photography to solar investigations, exhibits a similar appearance to an absolutely trustworthy photograph ob­tained at the eclipse of 1878. At the minimum period the chief feature is a very great extension of the corona in the direction of the solar equator, and a wonderfully exquisite outcurving right and left at both poles. It is probable that the equatorial extension pictured in the above-mentioned photograph is, after all, only a part of a much more extended phenomenon, one going to almost incredible distances from the sun itself. At the eclipse of 1878 precaution was taken to shield the eye of the observer from the intense light of the inner corona, which is sometimes so bright as to be mistaken for the sun’s limb, by erecting a screen which covered the moon and a space 12' high around it. The observer, Professor New­comb, saw on both sides of the dark moon a tremendous extension of the sun’s equator, far greater than that re­corded in the photographs taken at the same time. But the extended portions may have been so delicately illu­minated that they could not impress their image on the photographic plate during the time it was exposed, or that the light itself is poor in chemically active rays. The extension, as observed by the shielded eye, amounted to six or seven times the diameter of the dark moon. In a more favourable situation the same extension, but to a less extent, was observed without the aid of a screen. At a sun-spot minimum, therefore, there exists a great equa­torial extension of the corona east and west.

The time between the minimum and the maximum sun­spot periods is three or four years, and that from maxi­mum to minimum seven or eight years, so that the sun increases in activity much more rapidly than it afterwards decreases in passing to the next minimum. Starting, then, about half way between minimum and maximum, we find an increased activity in every direction. The quiet prominences, consisting of hydrogen, are more numerous, and the faculæ are brighter. If at this time we examine the spectrum of the chromosphere, we find hydrogen and D3 are not the only constituents : we get other short lines, the chief being the three lines of mag­nesium *bv b2, b4.* The spots are more numerous and are in a lower latitude, having moved from near 35° to about 25°. Metallic prominences now constantly accompany the spots ; and the number of bright lines visible in their spectra gradually increases from month to month. These changes are accompanied by changes in the corona, which affect not only its form but also its spectrum. At the minimum spot period the corona gives an almost continu­ous spectrum, differing only in the presence of a few dark lines, and occasionally a few not very obvious bright lines, whence we conclude that at the minimum the corona is not entirely gaseous. In passing from the minimum to the maximum the spectrum is no longer continuous : bright lines begin to appear, emanating from the incandescent gaseous portions of the corona, and at the same time there is an increase in brilliancy. At this period there is no longer any remarkable equatorial extension, although here and there streamers of strange outlines occur. A drawing of the eclipse of 1858, a period between minimum and maximum, shows in middle latitudes, both north and south, four remarkable luminous cones standing with their bases on the chromosphere. The amount of light and structure in the corona has increased to such an extent that the beautiful double curves seen at the poles at the minimum are now hidden in a strong radiance.

During the maximum period all the solar forces are doing their utmost, and we see in prominences and spots, and indeed in every outcome of action that we can refer to, indications of the most gigantic energies being at work. The ordinary prominences, instead of clinging to