contain other substances in addition to hydrogen. They are seen mounting upwards to enormous heights with almost incredible velocities, aud their ascent is accompanied by violent lateral motions. Such prominences have been seen with an upward velocity of 250 miles a second, and of a height as great as 400,000 miles. There is also evidence that some prominences consist of mixed up-rushes and down-rushes, and it may turn out eventually that this is the case in all the metallic prominences.

According to the gravitation-dissociation theory of the formation of spots, we ought to find that the effects, in various degrees, produced by down-rushes of associated matter are related to the effects, in like degrees, produced by the corresponding up-rushes of dissociated materials. Comparing, then, the facts already stated, we have :—

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| Effects of Down-rush. | Effects of Up-rush. |
| 1. Pores.  2. Veiled spots.  3. Quiet spots.  4. Disturbed spots. | 1. Domes.  2. Metallic strata and small pro­  minences.  3. Quiet prominences.  4. Metallic prominences. |

It is a fact that the pores and domes are very closely associated over all parts of the sun, and that the domes are most prominent in places previously occupied by spots. All large spots are seen to be accompanied by metallic prominences, when observed at the edge of the sun. There is also a strict relationship between the intensity of action going on in a spot and the associated prominence, so much so that a very violent change in a spot on the disk some­times causes the bright prominence lines to become visible in its spectrum. The ordinary metallic prominences, as already stated, may consist of both ascending and descending material ; this will be best understood by likening the whole phenomenon to a splash.

We have previously seen that spots and metallic prominences are very intimately connected as regards their occurrence in zones, and this intimacy is easy to explain by supposing things to happen in the way here set forth. The height of the solar atmosphere is greater over the equator than at the poles ; particles condensed on the outside at the poles have therefore a relatively small velocity when they fall into the photosphere, and are able to produce only pores or veiled spots. Over the equator the particles attain a higher velocity in their fall, but they also have to pass through a much greater thickness of atmosphere and undergo so much dissociation that on reaching the photosphere they are incom­petent to produce spots. In mid-latitudes, therefore, the falls of condensed particles should be most effective in producing spots. In this way the absence of spots at the poles and equator is ex­plained,—one of the best-known facts of solar physics. The falls of the condensed particles, or meteoric matter, iuto the sun increase the temperature of the atmosphere over the spots and prominences which they produce, so that other falls in the same region are not effective in producing spots on account of the increased dissociation which they must undergo before reaching the photosphere. If the material condensed in those regions is to produce a spot, it must be removed to some place where it can reach the photosphere with­out being dissociated. Hence from the first appearance of spots after a sun-spot minimum there is a continual change of latitude. From minimum to minimum there is a regular decrease in the latitude of spots ; hence it is clear that there must be currents from the poles towards the equator in the upper atmosphere of the sun, causing the removal of condensed materials to lower and relatively cooler latitudes. Assuming the existence of such currents, we ought to find that successive spots have a tendency to form along the same meridians, for the polar currents would carry the con­densed materials to lower latitudes in a nearly meridional direction. Examination of sun-spot records for 1878-79 shows that there is a marked tendency for spots to follow each other in meridians. The existence of such currents is further supported by the outcurving of the corona at the solar poles as observed in several eclipses. If these currents exist, there must also be compensating currents towards the poles in the lower parts of the sun’s atmosphere, carrying incandescent vapours along with them. Small prominences often give indication of motion towards the poles which such currents would produce, and examination of sun-spot records also shows that the tendency of the proper motion of the spots is polewards. Hence, although the existence of these currents has not been definitely proved, there is strong evidence that there exists some circulation of this nature in the solar atmosphere.

When once the falls have commenced, if this hypothesis is true, they should rapidly increase in intensity, for, as it is the falls which increase the temperature of the lower atmosphere by the conversion of their kinetic energy into heat, the more falls there are the more material will be taken first to the poles and then towards the equa­tor, and therefore there will be more available spot-forming material. But we know that this increase in intensity does not go on for ever, aud there must therefore be some regulating influence. The in­

crease of temperature and possibly of the height of the solar atmo­sphere, due to the increased falls, will eventually become such that the descending materials are dissociated before they reach the photosphere. The production of spots must therefore gradually diminish until they finally disappear and end the spot cycle. At the minimum period, therefore, pores and veiled spots, due to less powerful energies, are at a maximum.

Records of eclipses, occurring when the sun was quietest, show that the condensing and condensed materials brought to the equator by the polar currents probably extend far beyond the true atmo­sphere of the sun and are there collected, possibly in the form of a more or less regular ring the section of which widens towards the sun, the widest part being within the boundary of the sun’s atmo­sphere. If we assume such a ring under absolutely stable conditions, there will be no fall of material, and therefore no prominences or spots. But suppose a disturbance caused, as before, by collisions, whieh most likely occur where the particles brought by the polar currents meet the surface of the ring. These particles then fall from where the ring first meets the atmosphere on to the photo­sphere, and form the first spots. Eclipse records show that this action takes place about 30° lat. According to this view, there are usually no spots above 30° lat., because there is no ring, and because the atmosphere is too low to give the height of fall neces­sary to produce spots. There are no spots at the equator for the reason that the condensed matter has to pass for perhaps millions of miles through strata of increasing temperature, and do not there­fore reach the photosphere before being dissociated. Accordingly, we ought to find that at and after the maximum the corona is brighter and more truly a gaseous body on account of the increased temperature. This is in strict accordance with eclipse observations extending over twenty years. According to this view of the solar economy, the sun ought to give out more heat at a maximum than at a minimum period, when the number of falls is greatest ; on this point see the article Meteorology (vol. xvi. p. 167 *sq.).*

*The Sun’s Place among the Stars.*

The relative nearness of the sun makes it convenient as a type of those stars which on account of their great dis­tance are less accessible to minute observation. If the sun were at a greater distance, its spectrum would become much fainter and would not show so much detail, but its general character would not be altered : its dark lines would not become bright ones. In the atmospheres of the various members of the solar system, including the earth, there is a very considerable absorption of blue light. We know also that this condition applies to the sun. The light we receive under present conditions we call white ; but, if its own atmosphere and ours were removed or became so changed as to no longer absorb blue light, the sun would appear blue. If, on the other hand, the blue absorption were enormously increased, so that it extended into the green, the sun would appear red, be­cause every other kind of light would be absorbed. If two kinds of absorption—one in the red, the other in the blue —were going on together, as they sometimes do in our laboratories, the sun would then appear green. Although these changes are not of actual occurrence in the sun, we find each of these conditions represented among the stars. In the coloured stars, which may be red, green, or blue, we are simply dealing with this kind of absorption pheno­mena. This difference in the conditions of absorption in the stars, however, is by no means the most important one : the difference of temperature as indicated by the spectrum is of primary importance. As in our labora­tories the spectrum of a substance is changed by a varia­tion of temperature, and always in a regular way, so the nature of a star’s spectrum furnishes a clue to its probable state as regards heat. For example, we may submit carbon vapour to a low temperature, and we shall then obtain what is called a spectrum of flutings ; on increasing the temperature, the flutings are replaced wholly or partially by lines, according to the amount of increase. From hundreds of observations of this kind, both on carbon and other substances, it may be safely inferred that a fluted spectrum indicates a lower temperature than a line spectrum. There are doubtless substances in the sun’s atmosphere which, although represented by lines in its