

would find, as was discovered about eighty years ago, that the numbers and sizes of the spots and faculae varied, that they passed through a complete cycle of change, through maximum and minimum spottedness, in a little over eleven years. Another evident, and even obtrusive, fact of observation is that in addition to sending us a great deal of light we also receive a considerable amount of heat.

In addition to these observational facts let us recount a few well known dimensions. The sun, whose diameter is 865,000 miles, is situated nearly 93,000,000 miles from us. Its volume will evidently be  $(865/8)^3$  or 1,306,000 times that of the earth. A simple dynamical calculation, based on the known times of revolution of the moon around the earth and of the earth-moon system around the sun, shows that the sun has 332,800 times the mass of the earth. The density of the earth which has been very accurately determined by the physicists is 5.52 times that of water and hence the sun is 1.41 times as heavy as an equal volume of water. If expressed in pounds the mass of the earth is 1317 followed by 22 ciphers and of the sun 438 followed by 28 ciphers. It readily follows that the attraction of the sun at its surface is 27.6 times that of the earth at its surface, and a man weighing 150 pounds would weigh over two tons on the sun and would be crushed to death under his own weight if he had not been already turned into vapor long before he reached the surface.

The sun being 93,000,000 miles from the earth, it is evident, even to the least observing and thoughtful, that it must be exceedingly bright and hot to give such striking evidence of these effects at that enormous distance. No doubt most of us have been present at a fire and have noticed how rapidly the heat diminished as we moved away, that, even if unpleasantly hot at a hundred yards, it was quite comfortable at two hundred. It seems quite reasonable to say that, if the sun radiates so much heat at 93,000,000 miles, it must be hotter than any temperature attainable on the earth.

It is evident that no direct method of determining the tem-