

ASTRONOMY

Observations of Sunspot Variation

"A Classic of Science"

Schwabe's Years of Patient Observation Resulted in The Discovery of Mysterious Eleven-Year Sunspot Cycle

UEBER DIE FLECKEN DER SONNE, von Herrn Hofrath Schwabe. In Astronomische Nachrichten, Nr. 350. Altona (Germany), 1838. Translated for the SCIENCE NEWS LETTER by Helen M. Davis.

IN THE PAST year 1837 the activity of the sun in producing spots was so unusually great that I was induced to look back in my diary in regard to it, where I found a very noteworthy difference in earlier years. This strengthened my determination to publish the observations which I have made for the past 12 years upon their number and size, for a similar study is unknown to me.

I believe however that the following remarks upon the method are necessary, for, though indeed everyone knows how to make such observations, how persistently they remain neglected.

Since 1826, when I began to observe with two Fraunhofer telescopes of 3 and 6 ft. focal lengths, I have considered as groups only those crowds of spots which remain apart and are connected by no greater or smaller spots and no cloudiness. For this reason the count of groups depends upon the power of the telescope, and it often happens that crowds of many hundreds, indeed thousands of spots become only a single number, while one only stands by itself at the same time. But the tendency of the sun to bring the spots together into an aggregation is so great that different observers in the course of a year will in fact show but slight difference in count from my numbers. Moreover the influence which a significant difference will still have upon the result of my observations will be much diminished by a proportionate ratio, so I divide my results by the time during which I think they appeared as strongly as possible. It is not the number of groups but their reciprocal relation which seems to me worth counting, and this forms the purpose of this communication.

The first new spot which I see at the beginning of the year, I count as No. 1, and I continue by serial numbers until the end of the year, so that the old spots which continue over into the new year retain their numbers of the year before.

Of the two instruments, the 3½ ft. has an eyepiece with cross hairs for estimating the groups and a magnification of 45. With the 6 ft. I use a magnification of 64 only, to bring out every spot which must be counted in the group number, which would be overlooked in the small telescope on account of its faintness. Very seldom am I forced to use a magnification of 96 in doubtful cases. So I consider it practical to cover the objective with a capsule which for the 6 ft. has an opening of 2½ inches, and for the 3½ ft. of 1¾ inches, which can be widened by an arrangement if poor seeing in the heavens demands it. Through this I accomplish a two-fold purpose. First I avoid breaking the filters, which often causes a loss hard to replace, and second I can use brighter filters than if the objective kept its full opening. Besides, the best filters, which are unquestionably those of *Utzschneider* and *Fraunhofer*, lose in clearness and sharpness with greater saturation of color. I employ only the yellow and greenish colors, because they give the greatest definition and the least heating. . . .

Sunspots in Different Years

How different the numbers of sunspots and the size of the groups is at different times, the following resume and the remarks accompanying it show.

1826 I counted 118 groups
 1827 I counted 161 groups
 1828 I counted 225 groups
 1829 I counted 199 groups
 1830 I counted 190 groups
 1831 I counted 149 groups
 1832 I counted 84 groups
 1833 I counted 33 groups
 1834 I counted 51 groups
 1835 I counted 173 groups

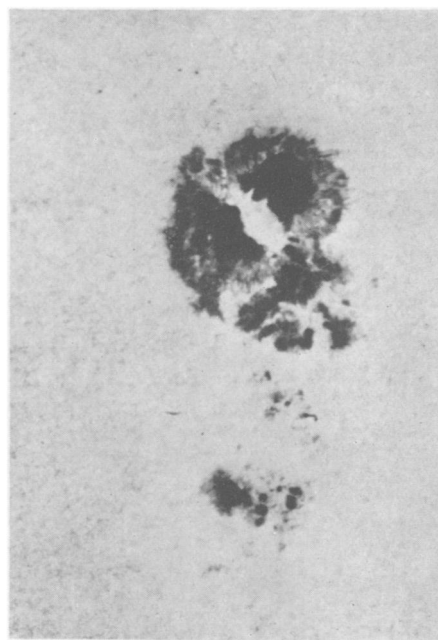
1836 I counted 272 groups
 1837 I counted 333 groups

1826 I observed on 277 days, of which 22 offered no sunspots and many were almost free in August and September. The groups were not very abundant, in March a spot of outstanding size was visible. I saw bright flecks on the 7th and 8th of July and the 3rd and 4th of August.

1827. Observation days, 273. The sun was without spots only on the 21st and 22nd of January. The groups were rather abundant, irregular seed-spots appeared often. I noted bright flecks in April, May, June, July, August, September and October often following one another.

1828. Observation days, 282. No day without sunspots. The groups were usually very abundant and their spots appeared very rapidly. In May and September a spot was visible to the unaided eye. Bright flecks were common in June, July, August; scarce in April, May and September.

1829. Observation days, 244. No day without spots. The groups were somewhat scarcer by the end of the year, and diminished in abundance of their spots. In April appeared a notably



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large seed-spot. Bright flecks were scarce in June and July.

1830. Observation days, 217. The sun was unspotted only on January 24th. The groups often contained irregular seed-spots. Bright flecks appeared only on July 6th, very slightly.

1831. Observation days, 239. The sun appeared only on May 12th, July 2nd, and December 11th without spots. The groups were not very abundant and became constantly scarcer, yet they seemed least in April. Many times there would be only one very regular seed-spot of medium size visible, which had few secondary spots in its train. In June and July appeared broad zones in which the spots arose through strong clouds of light, large grains and distinct pores so conspicuous that they were visible as two belts. Bright flecks were very abundant in July and August; in April, May and September scarce and alone.

1832. Observation days 270, of which 49 days unspotted; the most of these were in July, August and September. The groups very poor; little spots dissolved very rapidly. No bright flecks.

1833. Observation days, 267. The 139 days when the sun showed no spots fell particularly in June, July, August,

October and November. The spots were single and small, often only points, which sometimes disappeared in a few hours; in October a seed-spot was noticeable for its size and beauty. No bright flecks.

1834. Observation days, 273; 120 days without sunspots, which fell particularly in January, April, May, June, July and August; in December the spot picture increased considerably. No bright flecks.

1835. Observation days, 244. The 18 days without sun spots were mostly in January. The groups were many

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times composed of seed-spots with few grains and points. No bright flecks.

1836. Observation days, 200; on no day was the sun unspotted. The groups increased from March on very rapidly, yet the most numerous and abundant appeared only in one hemisphere of the sun. Most noteworthy was the sudden appearance of important seed-spots, and their changeableness. No bright flecks.

1837. Observation days, 168. The sun was never without spots, these increased constantly in the one hemisphere until it was seeded over with them, while more groups united through constantly appearing intermediate spots; their appearance and their changeableness was as sudden and as great as in former years; there appeared, however, more irregular seed-spots and such unusually great stretches of grains that after a chance counting and estimation these often added a thousand spots and points. Bright flecks I saw fairly plentiful only in August; in September scarcer and only one in October.

Heinrich Schwabe.

Dessau, February, 1838.

Science News Letter, April 25, 1931

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