

## ASTRONOMY

# Solar Prominence Streamers Linked With Sunspot Centers

## Study of 10,000 Sun Photographs at Yerkes Leads to Discovery of "Signposts" Pointing to Spot Activity

**N**EW-FOUND solar signposts that point out the location of sunspot activity were described before the American Astronomical Society by Dr. Philip C. Keenan of the University of Chicago's Yerkes Observatory.

The solar signposts are streamers coming out from the sides of the gigantic flames of glowing hot gas known as solar prominences. In some cases the prominences have been known to shoot out from the surface of the sun for distances up to 500,000 miles—more than the radius of the sun.

A study of over 10,000 sun photographs taken at Yerkes Observatory in the last 28 years led to the discovery of the sunspot signposts. Certain types of prominences seen near the sun's east and west edges show streamers moving towards or away from definitely located points on the sun's surface. When these points were checked against sunspot records, Dr. Keenan stated, they proved to be the centers of sunspot activity on the same date that the prominence was observed.

Roughly one can think of the solar prominences as the trunks of enormous trees shooting out from the sun's surface. The streamers, or sunspot signposts, would then be like branches coming out from the trunk; some pointing back toward the sun and others away from it. But the general line either toward or away from the sun is the crucial direction, for it points to the place of sunspot activity. If several such lines could be noted from different streamers the position of the sunspot could be determined by what would be almost similar to solar surveying.

### Near Solar Equator

The type of solar prominence which has the sunspot-indicating streamers is not seen near the sun's north or south poles but only near the equatorial belt. It is thought that the streamers are linked with the magnetic centers associated with sunspot areas. Since the solar prominences are composed of ionized atomic particles, some with positive and some with negative electrical charges, the magnetic field originating from the sunspots

makes those of one electrical sign move one way and those of the other sign in the opposite direction. It is this motion of electrical particles in the solar prominences which produced Dr. Keenan's telltale streamers, for as the charged particles move they radiate light. This light can be gathered by the telescope mirror and studied in such instruments as spectro-heliographs in which prominences can be photographed even when a total solar eclipse is not occurring.

In practically every case the actual center of attraction was located in the penumbra or outer part of the sunspot and not in the darkened center of the umbra of the solar disturbances. Dr. Keenan found, however, that some prominences occur as far as ten degrees from the location of a sunspot and considers that sunspots, while generally associated with prominences, are not essential to their formation. The velocity of these condensations of matter moving into the centers of solar disturbances ranged up to nearly

120 miles per second, although the average speed is about 30 miles.

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## ENGINEERING

## Grand Coulee Dam Tops Boulder Dam as "Biggest"

See Front Cover

**W**ITH construction on Boulder Dam now virtually complete, Grand Coulee Dam on the Columbia River is stepping to the engineering forefront.

Bids have just been opened by the U. S. Bureau of Reclamation for 4,220,000 barrels of cement for the Grand Coulee Dam. This mammoth order is said to be more cement than was used in the whole Boulder Dam, exclusive of the power plants. Yet it is less than half of what will be needed at Grand Coulee.

Already plans are underway for the utilization of the arid but fertile Columbia River basin after irrigation, made possible by Grand Coulee Dam, becomes a reality. Work relief funds amounting to \$250,000 have been authorized for soil classification studies, preparation of better topographic maps and the preparation of a land ownership map.

The cover photograph shows the Government bridge under construction at the damsite. It and the illustration below are official photographs of the U. S. Bureau of Reclamation.

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SITE OF GRAND COULEE DAM