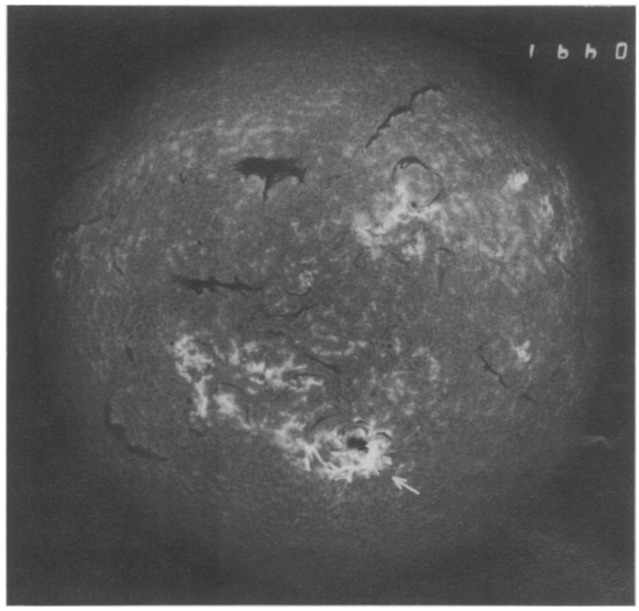
Fortnight of Flares Dazzles Astronomers

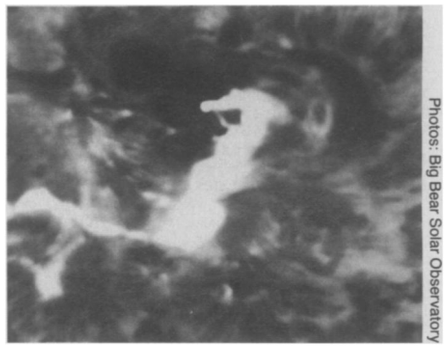
A series of spectacular flares erupted from a single region of the sun's surface during the first half of June, surprising scientists with their record-breaking brightness. "The intensity of these flares is shocking," says Alan L. Kiplinger of the National Oceanic and Atmospheric Administration (NOAA) in Boulder, Colo., who coordinated observations of the outbursts by more than 100 ground-based telescopes worldwide.

The stage was set May 18 when GOES-7, a NOAA satellite monitoring the sun, detected a large number of X-rays from a portion of the solar surface just before the region disappeared behind the sun's western edge. On June 1, just before it reappeared on the eastern edge, the region broadcast a booming announcement: a two-hour outburst of X-rays so intense that it saturated the satellite's measuring equipment. The total X-ray output from this violent event exceeded that of any other solar outburst recorded since such measurements began in 1974, Kiplinger says.

Minutes later, observers detected the first of six major, visible-light flares as the eruptive area — now dubbed active region 6659 — began migrating westward across the solar disk. Five of these, detected from June 1 through June 15, saturated GOES-7's X-ray detector. This was the largest number of high-intensity solar flares ever known to erupt from a single region, says NOAA solar forecaster Willow Cliffswallow. She and other researchers suspect that the active region, which again rolled behind the sun's visible disk on June 15, will fizzle out by the time it reappears at the end of the month.

The flares held other surprises. Due to the relative positions and rotations of our planet and the sun, the eastern portion of the solar disk should only weakly affect Earth's magnetic field. But charged particles that spewed out from the flares — including the easternmost flare — caused a variety of geomagnetic disturbances, interrupting radio communications and extending a dazzling display of aurora borealis as far south as Colorado, Cliffswallow reports.





Photos: Big Bear Solar Observatory

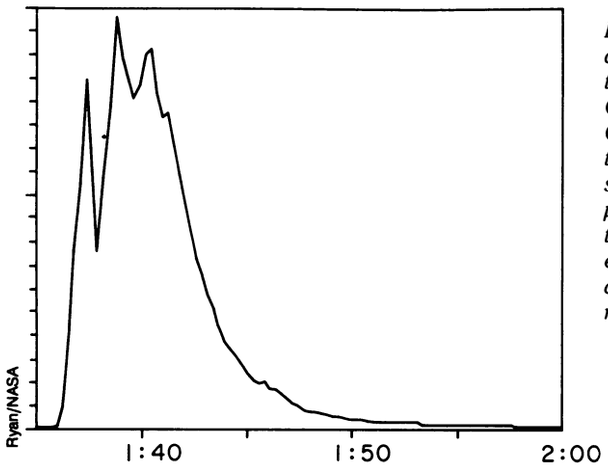
Image of solar disk depicts hydrogen emission from the brilliant flare (arrow) recorded June 9 with an 8-inch telescope at the Big Bear Solar Observatory in California. Bottom photo, taken by a 10-inch vacuum telescope at Big Bear, shows close-up view of the same flare.

Measurements with the Gamma Ray Observatory (GRO) may offer the best chance for understanding the solar phenomenon, Kiplinger and others note. One of GRO's four detectors, the Oriented Scintillation Spectrometer Experiment (OSSE), began focusing on the sun June 1 and managed to observe parts of five later flares, reports Ronald Murphy of the Naval Research Laboratory in Washington, D.C. On June 7, ground controllers rotated the orbiting observatory so that all four detectors faced the sun.

OSSE detected bursts of gamma rays — high-energy photons — from the sun at energies greater than 10 million electron-volts, Murphy told SCIENCE NEWS. Scientists believe solar flares erupt in a sudden release of energy when magnetic field lines snap or are abruptly annihilated in a localized area of the sun. The energy release causes streams of charged particles to head into space, and others to slam into atoms at deeper layers of the sun.

Some of those collisions excite the nuclei of the sun's atoms, causing them to emit characteristic gamma rays, Murphy notes. He says a preliminary analysis indicates that OSSE detected such emissions from carbon and oxygen atoms, among others — a finding that may help researchers deduce the relative abundance of elements in the lower layers of the sun's atmosphere. In other, more violent collisions, Murphy says, incoming charged particles rip apart the atoms, creating high-energy neutrons and gammas. OSSE appears to have detected neutrons, which should reveal the energy of the charged particles just before they hit the atoms.

GRO's Compton Telescope observed gamma rays bursting from two of the flares, and also appears to have recorded neutrons, says astrophysicist James M. Ryan of the University of New Hampshire in Durham. — *R. Cowen*



Intensity of gamma rays at an energy of 70,000 electron-volts, recorded by the Gamma Ray Observatory's Compton Telescope during the June 9 flare. Curve shows several adjacent peaks over a 10-minute interval, possibly indicating emissions from neighboring areas within the active region.

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