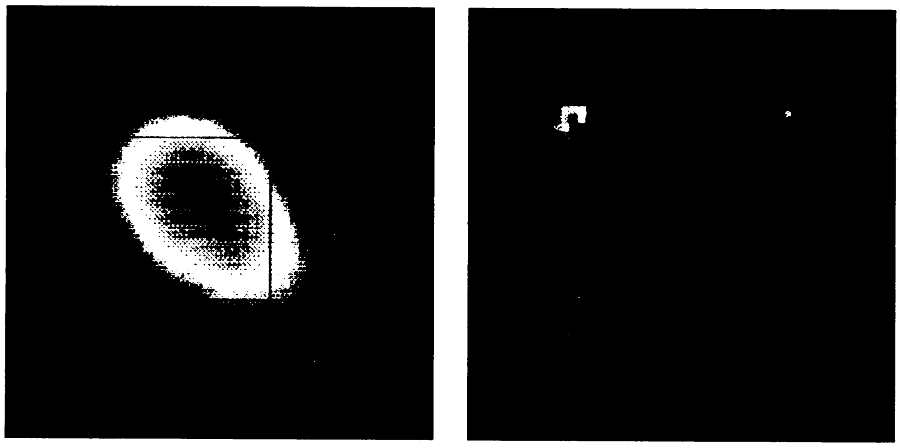
star undergoes flares many times more intense than those on the sun. Hubble's Goddard High-Resolution Spectrograph monitored the star for some three hours last Sept. 3, but it detected enhanced emission of a particular wavelength of ultraviolet light for a mere 3.2 seconds – just at the onset of a flare, when astronomers had predicted a higher intensity would occur.

According to theory, as protons stream down from the corona, they knock into hydrogen atoms, robbing each of its solitary electron. Each electron then pairs with a proton to form a new, downward-moving hydrogen atom. The newly created atoms briefly emit a type of ultraviolet light called Lyman-alpha emission.

And because the atoms are moving toward the surface of the flare star, away from Earth, the ultraviolet light they radiate appears to have shifted to a slightly redder, or longer, wavelength. Bruce E. Woodgate of NASA's Goddard Space Flight Center in Greenbelt, Md., reported that Hubble measured red-shifted Lyman-alpha emissions as the flare began, indicating that hydrogen atoms were streaming toward the star at about 1,800 kilometers per second.

Woodgate notes that the finding doesn't preclude the possibility that electron beams also carry some of the energy unleashed by magnetic activity. But the observations hint that protons serve as the dominant energy carrier in AU Microscopium – and perhaps in other stars, including the sun.

In June 1991, the Compton Gamma Ray Observatory (GRO) recorded high-energy emissions from the sun during a month of spectacular flares (SN: 6/22/91, p.388). The findings, also reported last week, indicate that magnetic fields in the corona help create an afterglow of gamma rays and neutrons for many minutes to hours after flares begin. James M. Ryan of the University of New Hampshire in Durham announced that GRO's EGRET telescopes detected solar gamma rays for more than five hours after a flare began on June 11, 1991. Four days later, GRO's Compton Telescope detected gamma rays and neutrons for more than 90 minutes after the onset of another flare.



Photos: NASA

Neutron emissions from the sun (left), recorded an hour after a flare's onset June 15, 1991, marks the first time a celestial object has been depicted using these subatomic particles. Red denotes highest intensity. Images at right show that the sun emits gamma rays for more than an hour after the X-ray peak of the flare.

The findings, says Ryan, support the theory that some protons get trapped in the magnetic arches of the corona, rattling back and forth inside a kind of magnetic slinky. Earth's Van Allen radiation belts trap protons in a similar way, he adds. As the protons slowly leak out of the slinky, they strike atoms near the solar surface, accounting for the extended neutron and gamma-ray emissions.

In imaging the spray of neutron particles from the sun, the Compton Telescope made astronomical history. The blurry picture marks the first time that researchers have used neutrons to image any celestial object. The spectra of neutrons, Ryan adds, may provide more information than gamma rays about the energy of the trapped protons and the nature of the magnetic fields that accelerated them. *– R. Cowen*

Runaway greenhouse gas losing its steam

Although the international community missed its opportunity in Brazil last month to set limits on carbon dioxide emissions, not all the news under the greenhouse is bad. Without even trying, humans have apparently succeeded in slowing the atmospheric buildup of methane, another powerful greenhouse gas, scientists reported this week.

Measurements made around the world reveal that while concentrations of methane continue to increase, they are not rising as quickly now as they were almost a decade ago. In 1983, methane levels were climbing at 13.3 parts per billion per year. But by 1990, the rate of increase had dropped to 9.5 parts per billion per year, according to researchers with the National Oceanic and Atmospheric Administration (NOAA), the University of Colorado at Boulder, and the Australian Commonwealth Scientific and Industrial Research Organization, based in Mordialloc, Victoria. They describe their findings in the July 23 NATURE.

Climate experts worry about rising methane levels because the buildup of this gas accounts for roughly 15 to 20 percent of the greenhouse warming power added to the atmosphere each year. Methane comes from natural sources as well as from human activities such as cattle rearing, rice farming, and the mining of fossil fuels.

The researchers analyzed a data set of roughly 10,000 air samples, collected at 37 sites scattered around the world, mostly on islands. While the scientists cannot pinpoint what has put the brakes on the methane buildup, the pattern of recent changes offers some clues.

The data indicate that the greatest slowdown in methane accumulation has occurred in the higher latitudes of the northern hemisphere. "The fact that that's where most of the industrialized world lives, in that latitude zone, suggests that there's some human involvement in this decrease we're seeing," says Edward J. Dlugokencky, a NOAA researcher based in Boulder.

Other groups have also detected a drop in the methane accumulation rate, but they relied on less extensive sampling networks that cannot reveal as much about the regional pattern of methane changes, Dlugokencky says. If the present trend continues, methane concentrations will level off in about 15 years. But without knowing what has caused the changes, scientists cannot predict what will actually happen with methane, Dlugokencky adds.

F. Sherwood Rowland, an atmospheric chemist at the University of California, Irvine, mentions several factors that could explain why the buildup of methane has slowed. Between 1950 and 1975, the number of cattle in the world increased from 800 million to 1.25 billion, but since 1975 the cattle population has leveled out. Rice production seems to have followed a similar pattern of rapid increase followed by a slowdown. Lastly, oil companies apparently changed their practices during the late 1970s to cut down on methane loss during oil extraction. Because methane persists in the atmosphere for a decade, any or all of these changes could have caused a slowdown in methane buildup during the 1980s. *– R. Monastersky*