Solar-flare neutrons from sun to earth

The thermonuclear processes that go on in solar flares ought to produce neutrons as well as the charged particles (protons and electrons) with which terrestrial observers have long been familiar. Now, for the first two times such solar-flare neutrons have been detected near the earth, and for the first time on the surface of the earth. Neutrons from two flares, on June 3 and June 21, 1980, were recorded by the earth-orbiting Solar Maximum Mission satellite. Neutrons from the June 3, 1980, flare were also detected at the Jungfraujoch Observatory in Switzerland.

The discovery gives a new means for gaining information about what goes on in solar flares. It provides a way of warning astronauts, space experimenters and geophysicists of the imminent arrival of the charged particles from a flare. The neutrons come straight through and arrive before the charged particles, which are constrained into curved paths by the interplanetary magnetic field. The charged particles can cause injury to astronauts, problems for space experiments, and ionospheric phenomena, including communications disturbances, on earth.

E.L. Chupp of the University of New Hampshire led the groups involved in both observations. The June 21 flare, which was reported first (in the Dec. 15 ASTROPHYSICAL JOURNAL LETTERS), was studied by 10 scientists from UNH, the Max Planck Institute for Physics and Astrophysics at Garching bei München, West Germany, and the Naval Research Laboratory. The June 3 flare was reported by Chupp at last week's meeting of the American Astronomical Society in Boston on behalf of himself and five others from UNH, the MPI at Garching and the University of Bern.

The possibility of receiving neutrons from a solar flare at the earth depends critically on the energy they are given at their origin. Neutrons are radioactively unstable and decay after a half-life of 11 minutes. The transit time for light from the sun to the earth is a little over 8 minutes. That means that neutrons must have about 8/9 the speed of light to reach the earth in appreciable numbers. The discovery is first of all a confirmation that solar flares do produce such high-energy neutrons (with energies greater than 50 million electron-volts). It took the specially constructed Gamma Ray Spectrometer of the Solar Max satellite, which records first the gamma rays that come from a flare (with the speed of light) and then any slower electrically neutral particles, to make sure of them. The ground observation at the Jungfraujoch was of showers of secondary particles produced as the neutrons struck the earth's atmosphere.

The discovery may also mean that records of older flares may have to be revised. Now that scientists know neutrons are produced in flares, they have to reason that the slower neutrons will have decayed into protons on the way. Thus, all the protons received at earth from a given flare may not have been originally produced as protons, and the data will have to be recalculated to account for that.

—D.E. Thomsen

Extra piece of DNA indicted in diabetes

Noninsulin-dependent diabetes (mature onset diabetes) is known to have a genetic component, but what gene or genes is involved is a mystery. However, some genetic material has now been implicated in the disease. According to Peter S. Rotwein of Washington University School of Medicine in St. Louis and colleagues, the material consists of an extra piece of DNA located at the beginning of the human insulin gene. Their report appears in the Jan. 13 NEW ENGLAND JOURNAL OF MEDICINE.

Several years ago Rotwein and colleagues, among others, attempted to see whether DNA flanking the insulin gene was any different among noninsulin-dependent diabetics, insulin-dependent diabetics (those suffering from a total lack of insulin) or healthy persons. They found that the length of a region of DNA at the start of the insulin gene varied more often in noninsulin-dependent diabetics than in insulin-dependent ones or in healthy subjects. This finding suggested that genetic material in this region might influence the development of noninsulin-dependent diabetes because the disease is characterized by a partial insulin deficiency and because genetic material at the start of the insulin gene might modulate the amount of insulin produced.

Now Rotwein and his team have compared insulin-associated DNA in 104 noninsulin-dependent diabetics, 26 insulin-dependent ones and 87 healthy persons and found an extra piece of DNA — most commonly one 1,600 base pairs in length —significantly more often among the noninsulin-dependent diabetics than among the insulin-dependent ones or among healthy subjects.

The implications of the extra piece of DNA aren't clear, particularly as some insulin-dependent diabetics do not have it and some individuals without the disease do. Rotwein and his co-workers believe that it may play a causative role in the disease or at least serve as a genetic marker for it. Investigators doing similar genetic research or other kinds of diabetes research aren't so sure. In any event, as George F. Cahill Jr., director of the Joslin Diabetes Center in Boston, points out, the challenge now is to find out what the extra piece of DNA codes for, if anything.

— J.A. Treichel

Strontium sources and filtering firs

The windblown needles of spruce and fir trees are proving to be such efficient air filters that airborne particles are important sources of mineral nutrients for these trees. Applying a strontium isotope technique normally used for dating rocks, William C. Graustein, a Yale University geochemist, has shown that more than 75 percent of the strontium in samples of mountain vegetation from New Mexico originates as trapped, airborne material, subsequently washed into the soil and picked up by the roots. Less than 25 percent comes from minerals produced by the weathering of underlying rocks. Weathering used to be considered the more important mineral source.

Graustein also reports in the Jan. 21 SCIENCE that spruce and fir trees can collect almost 5 times more airborne particles than a simple bucket collector left in the open. But unlike coniferous trees, deciduous trees such as aspen trap few, if any, strontium-bearing particles. However, recent tests show little difference between coniferous and deciduous trees in catching particles smaller than the calcium carbonate particles associated with strontium. Thus, measurement of particle deposition is complicated because both particle size and tree species affect the filtering ability of tree foliage.

Biologist James R. Gosz of the University of New Mexico says that for ecosystems where vegetation collects particles readily, conventional analyses often grossly underestimate actual atmospheric input. The strontium isotope technique provides a new way of estimating weathering and atmospheric inputs to ecosystems. In the January BIOSCIENCE, Gosz and his colleagues write, "We expect that this technique can become an important procedure for nutrient budget studies in certain areas."

The technique depends on small differences in the ratio of two isotopes, strontium-87 and strontium-86. Granite-bearing rocks tend to have more strontium-87 than rocks like basalt or limestone, so that granite has a higher ratio of the two isotopes. If windblown dust travels from, say, a limestone region to another where the rocks have a different composition, then material from the two areas can be distinguished. Gosz calls the strontium isotope ratio "a natural tracer of atmospheric inputs."

Graustein portrays his study as "a geologist's attempt to describe the effect of a tree." Initially, he was exploring the factors that control stream water chemistry, and this led him to consider the tremendous effect of vegetation and the role of atmospheric inputs. Now, Graustein is investigating lead-210 as a natural tracer for sulfate particles.

—I. Peterson