Astronomy

Dietrick E. Thomsen reports from Baltimore at the meeting of the American Astronomical Society

Q nuclei: Quarks to cure solar quirks

According to standard theory, the sun should emit a flux of neutrinos equal to about 6 SNU (solar neutrino units). (One SNU equals one neutrino capture per million target atoms per second.) An experiment running for about a decade and a half consistently records only 2 SNU.

For about the same length of time another experiment seems to be showing the existence of electric charge on small niobium balls in fractions of the usual base unit. This can be interpreted to mean that an odd quark has attached itself. Quarks, the building blocks of neutrons, protons and many other particles, are supposed to have fractional charge. However, when they add up properly to form neutrons and protons, the results are 0 and 1, respectively. Fractional charge on a ball means it may contain an extra quark.

Four astronomers from Ohio State University in Columbus, C. L. Joseph, R. N. Boyd, R. E. Turner and L. Rybarcyk, have taken these two circumstances to propose a theory of solar nucleosynthesis by way of Q nuclei, nuclei with extra quarks attached. They envision a cycle catalyzed by a helium 4 nucleus with an odd "up" quark attached (symbolically, $^{4}He^{u}$), in which lithium in the form $^{6}Li^{u}$ plays a pivotal role. With a ratio as low as one Q nucleus to 10^{15} normal ones, this cycle would suppress neutrino production to the level seen by experiment. It could also shorten the lifetime of the sun and sunlike stars by 10 to 20 percent, and if the lithium Q nuclei were more than 2 in 10^{16}, it would give the sun a core in which convection occurs.

Astronomical rush for time in space

When the Space Telescope (ST) flies, an event now scheduled for late 1986, astronomers will be lined up like the destitute at a soup kitchen trying for a little observing time. In the words of Neta A. Bahcall of the Space Telescope Science Institute in Baltimore, who is in charge of the scientific program of the ST, it will be "heavily oversubscribed."

Bahcall says her office sent out 7,000 questionnaires to astronomers all over the world. They got back more than 3,000 replies. The overwhelming majority said they definitely or probably would want to use the ST. As a result, Bahcall says, she figures they will get requests for about 15 times the 3,000 observing hours per year the ST will be able to supply. This overrun is "more than any other observatory," she says, and quotes figures for Kitt Peak and the European Southern Observatory (3 to 1).

In the light of all these numbers, Bahcall says, she wants to set up more than the usual procedures to insure that the proposals all "do not land on my desk." She and co-workers intend to allocate the telescope's time in thirds to short term (up to four hours), medium (20 hours) and long (100 hours) observations. Otherwise, they fear, worthy projects that require long observing time to build up consistent data might lose out in the temptation to approve large numbers of quick projects.

In addition to the usual review committees of experts in different fields, Bahcall hopes the community will help her in new ways. For short projects, instead of each astronomer asking for separate time and "going home with one [quasar] in their pocket . . .," she would like several to club together and ask for ten, each taking the data relevant to his or her study. For the long-term projects, she wants the community to get together and identify key investigations that should have priority.

There was concern how unpopular projects would fare. Geoffrey Burbidge, a prominent astronomer, asked: "How will Arp get time?" Halton Arp has an unpopular theory of quasars, and his persistence annoys some colleagues. Bahcall replied that anybody can apply and peer review will determine. But it is just peer review, Arp himself alleges, that prevents him from getting time on major telescopes, even those belonging to his own university (California Institute of Technology).

Science & Society

Acid rain annual report

While recent research results have reduced concerns about acid rain damage to crops, fears of possible effects on forests are increasing, says the second annual report of the congressionally mandated National Acid Precipitation Assessment Program (SN: 6/18/83, p. 390). During the past year, carefully controlled experiments involving simulated acid rain revealed that crops like potatoes and corn suffered no adverse effects and most of the tested varieties of soybeans sustained only minor damage and little change in yield. Many of the earlier studies that showed damage to crops were not properly designed, says Chris Bernabo, the program's executive director.

In contrast, acid deposition may be one of the factors that have caused significant reductions in the growth and vitality of several tree species in eastern U.S. and European forests (SN: 4/7/84, p. 215). This could represent a much larger potential economic threat than the reported damage to lakes and streams, says Bernabo. "Although natural factors may be involved," the report says, "they alone do not seem to explain adequately the observed change."

The report also notes a shift in the "benchmark" level of acidity (pH) for rainfall in the absence of pollution. Researchers now believe that the normal pH for rainfall is closer to 5.0 than to 5.6, the previously assumed value that reflected the amount of carbon dioxide dissolved in water. The new, lower benchmark pH level (higher acidity) adds the effect of organic acids that come primarily from natural sources. Thus, rainfall in the Northeast is on the average only about seven times rather than 25 times more acidic than unpolluted rainfall, says Bernabo.

In summarizing the year's work, Bernabo says, "We have tried very hard to give an objective baseline." Although the science is "rather immature," he says, "there is no question that the concern about acid rain is and should be nationwide."

Renewing U. S. mathematics

"Mathematics research has been seriously underfunded despite the fact that research opportunities are at an all-time high," comments Edward E. David Jr. in an editorial in the June 15 SCIENCE. David was chairman of a National Academy of Sciences ad hoc committee on resources for the mathematical sciences, which earlier this month released its report "Renewing U.S. Mathematics." As expected (SN: 2/4/84, p. 71), the report calls for a doubling in federal support for mathematics research, raising it from the current $78 million per year to $180 million.

"While the uses of mathematics in other fields have been supported, somehow the needs of fundamental mathematics were lost sight of for over a decade," the panel states. "Since there is about a 15-year delay between the entry of young people into the field and their attainment of the expected high level of performance, this decade of neglect alarms us." Part of the problem lay in the lumping together of funding for mathematics and computer science research during congressional budget considerations. While funding for computer science grew, the mathematics part did not grow at all, according to the report.

"It will be up to the Administration and Congress to decide what national priority to assign these needs," the report concludes. But it will be up to the mathematical sciences research community "to develop mechanisms for effectively presenting their needs."

New director for NSF

After less than two years as director of the National Science Foundation (SN: 11/13/82, p. 309), Edward A. Knapp has decided to return to physics research at the Los Alamos National Laboratory in New Mexico. Knapp's successor is expected to be Erich Bloch, an engineer and vice president at IBM Corp.