Signature of the Missing Mass

If neutrinos have rest mass—and a good deal of current excitement in particle physics is based on the expectation that they will prove to have it (see p. 298, this issue, also SN: 10/11/80, p. 228)—they are quite useful to cosmologists. Swarms of neutrinos in truly astronomical numbers could provide the necessary mass for the gravitational binding of clusters of galaxies. At the same time, they could provide the mass needed to make space nearly flat.

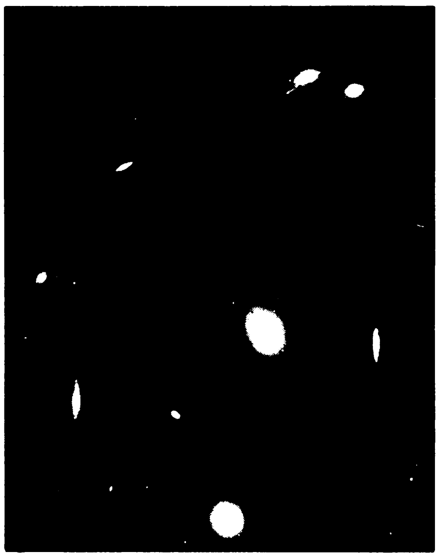
A lot of astronomers judge that the evidence shows that clusters are bound and that space is flat, but they cannot see enough glowing (and radio-emitting and X-ray-emitting, and so forth) matter to do those jobs. Neutrinos would be useful because they can do the job while being invisible. Or almost invisible. Recently, A. De Rújula of the CERN laboratory in Geneva and Sheldon Glashow of Harvard University suggested that these supposed massive neutrinos might decay radioactively into lighter neutrinos and photons of light (SN: 9/20/80, p. 181). Calculating the probable energy of these photons De Rújula and Glashow put them into the ultraviolet frequency range. Now Floyd Stecker of the NASA Goddard Space Flight Center in Greenbelt, Md., suggests that a glow from such neutrino decays may already have been seen.

The source of these cosmic neutrinos is the big bang. They were created in the act that started the universe. If they do not possess rest mass (and this is the former and still current belief about neutrinos), they can float around the cosmos till the end of time without affecting the cosmic economy very much. If they have rest mass, they can do the gravitational work laid out for them, but at the cost of radioactive decay for themselves.

The general expectation is that any particle with rest mass will sooner or later decay into something lighter. Only the electron and the proton seem immune, and there is strong theoretical reason to suspect proton decay. The theoretical problem is to select a decay mode for heavy neutrinos that is plausible according to their characteristics and yet gives a lifetime for the heavy neutrinos that permits the largest part of them to remain until the present epoch, which could be 17 billion years since their creation. A heavy neutrino decaying into a lighter neutrino and a photon seems to fit.

In the Oct. 27 PHYSICAL REVIEW LETTERS Stecker points out that the spectrum of the ultraviolet background glow in the sky as measured by Richard Henry of Johns Hopkins University and collaborators and also by a French group working with the French D2-B spacecraft shows an intensity enhancement, a bump, around 1,700 angstroms wavelength. Stecker argues that this feature can be the result of a spectral line about 1 angstrom wide produced by decaying neutrinos in the halo of our own galaxy, provided the lifetime of heavy neutrinos against this kind of decay is 10^{17} years.

The narrowness of the line is expected from the consideration that the expansion of the universe has cooled the neutrinos nearly to absolute zero so that they are virtually at rest. Thus the energy given to the photons in the decay process depends almost entirely on the difference between the masses of the heavy and light neutrinos. There is some range of possibilities, but keeping in mind the cosmological function of these neutrinos, Stecker picks the most probable for the heavy neutrino as around 14 electron-volts. This is in the range talked about by those physicists who favor a neutrino mass so small that it would have escaped detection before now (there is also a school that says it is much too large to be observed, but that's a different story). Stecker's figure is also consistent, as he points out, with the only experiment in the world now reporting numbers for the mass of a neutrino, the one at Novosibirsk in Siberia (SN: 10/11/80, p. 228). □


Kitt Peak

The hidden mass that keeps galaxy clusters together may have a slight UV glow.

Science advisor nominated to head NAS

Frank Press, who for the past four years has served as the Carter administration's chief spokesman on science and engineering, has been nominated to succeed Philip Handler as president of the National Academy of Sciences. The 56-year-old geophysicist was the only candidate named by the academy's 17-member nominating committee. Although NAS members may add to the list of candidates, the committee's choice virtually always triumphs.

From his post as director of the President's Office of Science and Technology Policy, Press has been one of the chief executive's closest advisors. But early on, Press vowed he would keep the position only one term. He currently plans to resume teaching at the Massachusetts Institute of Technology, perhaps beginning as early as the spring term.

Handler, too, plans a return to the classroom. When he steps down from a second six-year term — the maximum allowed NAS presidents — next June 30, he is expected to be named James B. Duke professor of biochemistry at Duke University. Handler formerly chaired the school's biochemistry department.

NAS is a federally chartered, private organization with nearly 900 committees and a staff of 1,100. Its 1,324 honorary members—including some of the nation's most distinguished scientists — will be asked to cast ballots by Jan. 15 to decide Handler's successor.

In his administration of this body, Handler gained a reputation for being outspoken, particularly in regard to issues such as human rights. In contrast to this somewhat flamboyant style, Press cuts a decidedly cautious, and some say "political," figure. But observers suggest that both men share much the same philosophy, including a commitment to emphasizing federal funding of basic research.

One potential hitch could stall the Press nomination: the 1978 Ethics in Government Act. Its provisions prohibit federal employees from wielding influence over their former office for two years after they leave government. Lawyers are already looking into this. □


OSTP

Press: Carter's outgoing science advisor.