

W. W. Webb and R. J. Warburton,⁸ also at Cornell, were thus moved to try new experiments. Choosing to observe the transition in highly perfect tin whisker crystals, they found that the effect was at least as small as had been predicted by the detailed theory, but that the tiny effect of intrinsic fluctuations did seem to occur.

References

1. R. E. Glover, *Phys. Letters* **25A**, 542 (1967); R. A. Ferrell, H. Schmidt, *Phys. Letters* **25A**, 544 (1967).
2. M. Strongin, O. F. Kammerer, J. E. Crow, R. S. Thompson, H. L. Fine, *Phys. Rev. Letters* **20**, 922 (1968).
3. R. O. Smith, B. Serin, E. Abrahams, *Phys. Letters* **28A**, 224 (1968).
4. L. G. Aslamazov, A. I. Larkin, *Phys. Letters* **26A**, 238 (1968).
5. W. A. Little, *Phys. Rev.* **156**, 396 (1967).
6. R. D. Parks, R. P. Groff, *Phys. Rev. Letters* **18**, 342 (1967); T. K. Hunt, J. E. Mercereau, *Phys. Rev. Letters* **18**, 551 (1967).
7. J. S. Langer, V. Ambegaokar, *Phys. Rev.* **164**, 498 (1967).
8. W. W. Webb, R. J. Warburton, *Phys. Rev. Letters* **20**, 461 (1968).

Interstellar Medium Has Biological Preservative

Interstellar formaldehyde (H_2CO) has been discovered by a group working with the 140-foot radio telescope at Green Bank, W. Va. They observed the molecule in absorption against many galactic and extragalactic sources. The discovery suggests that all the known ingredients for development of life are present in interstellar space.

Five different molecules have been found in the interstellar medium: H_2O and NH_3 were both recently reported (*PHYSICS TODAY*, March, page 63 and February, page 67); OH, CH and CN have been known for several years.

The observers, Lewis Snyder and David Buhl of Green Bank, Benjamin Zuckerman of the University of Maryland and Patrick Palmer of the University of Chicago, say (*Phys. Rev. Letters*, 31 March) that they found H_2CO in clouds at various distances between earth and the background radio sources in 15 out of 26 positions checked. They conclude that large regions of the galaxy may be filled with clouds containing formaldehyde at densities comparable with that of OH. Its "widespread distribution indicates that processes of interstellar chemical

evolution may be much more complex than previously assumed," the observers say.

It is generally believed that primitive life forms could develop in an atmosphere of methane, ammonia, hydrogen and water. Despite the inability of radio telescopes to observe methane transitions, the presence in interstellar space of water, ammonia and now formaldehyde suggests that methane and a number of other molecules are up there, too.

Giant Scintillation Counter Is Good for High Energies

An overgrown NaI(Tl) crystal makes an excellent detector of all kinds of high-energy particles (including neutrals), according to Robert Hofstadter of Stanford, who spoke at the New York meeting of the American Physical Society. He, E. Barrie Hughes, William L. Lakin and Ingo Sick tested their total-absorption detectors in a secondary beam of electrons and pions at SLAC and also at the Stanford 1-GeV linac.

Although total absorption gamma detectors, in which a large block of scintillator produces a light pulse proportional to the gamma energy, are popular for nuclear-physics experiments, the Stanford work is the first to explore such detectors in the GeV range (*Nature* **221**, 228, 1969). Hofstadter and his collaborators used NaI(Tl) because it has an excellent scintillation yield, a high density (3.7 g/cm^3) and a correspondingly small radiation length (about 2.5 cm). However, for detection of GeV particles the crystals must be huge.

The Stanford detector consists of six separate crystals, whose sizes ranged from 29 to 33 cm in diameter and 9.5–18 cm in thickness. Each crystal is sealed in a thin aluminum case and viewed radially by four photomultipliers. The six crystals are mounted coaxially to simulate one large crystal 69 cm thick along the beam axis.

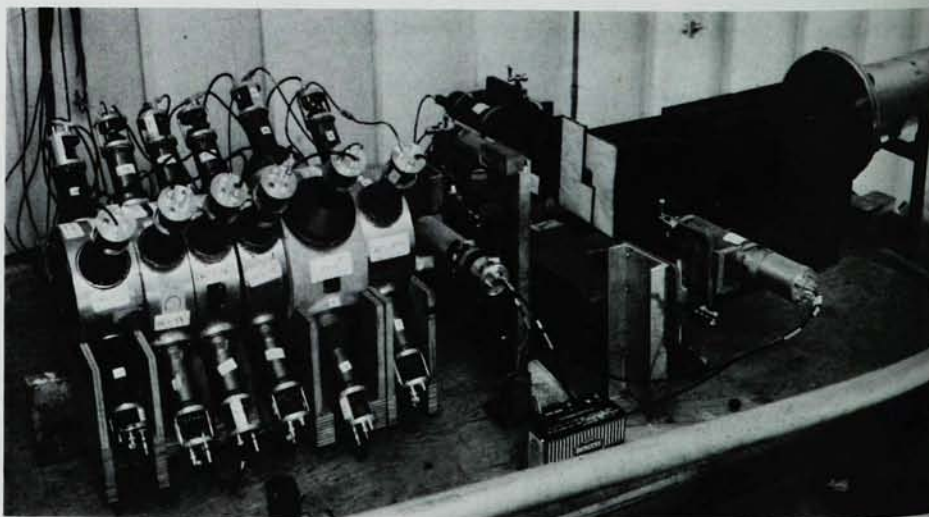
Energy resolution for an incident electron or gamma ray is 1–2% for the energy range 4–14 GeV. Unlike some other devices this resolution improves as energy increases. Hofstadter says that the theoretical resolution of the detector is 0.02%, but a more realistic figure is 0.1%.

The NaI(Tl) crystals can also be used to detect strongly interacting particles, but they must have larger diameters and greater lengths. The Stanford experimenters constructed a total-absorption nuclear-cascade counter by stacking crystals in a 1.5-meter row. Using a tin simulator they studied containment of particle energy as a function of detector radius and length. Results, allowing for equipment limitations, suggest that a TANC counter made with crystals of sufficient size (about 80-cm diameter) should give very useful resolution.

Hofstadter says that there is "virtually no limit to the highest energy detectable by the detector."

Electron Cloud to Produce Highly Stripped Heavy Ions

Positive ions trapped in electron clouds are exciting interest among high-energy and low-energy physicists alike. While those interested in making high-energy protons (and perhaps heavy



TOTAL-ABSORPTION DETECTOR at Stanford has six NaI(Tl) crystals. Energy resolution for electrons or gammas is 1–2% for the energy range 4–14 GeV.