Lawrence Berkeley Laboratory and the Stanford Linear Accelerator Center, working with the SPEAR storage ring at SLAC, found the same particle in collisions of electrons and positrons and named it psi. Since then, a series of half a dozen or more related particles have been discovered or claimed in various laboratories.

On all of this, theorists have had a field day. Becker says more than 2,000 theoretical papers have been published in the past year, in attempts to explain the J-psi phenomena. Each new experimental finding causes theorists to adjust their hypotheses and provokes a new spate of publication. So feverish is the activity, says Becker, that "excited physicists from all over the world often call the MIT control room at Brookhaven at 2 or 3 o'clock in the morning to ask Professor Ting or me for our latest results, instantly modifying their theories accordingly." But amidst major and minor differences of opinion and ad hoc modifications as experiments continue, the overwhelming majority of the theorists opt for some form of the charm hypothesis.

To this Becker responds that the recent MIT experiments show that "the current theoretical attempts to explain the J particle probably need major modifications." In fact, from the actual experimental results only a few conclusions about the J-psi's can be drawn, according to Ting and Becker.

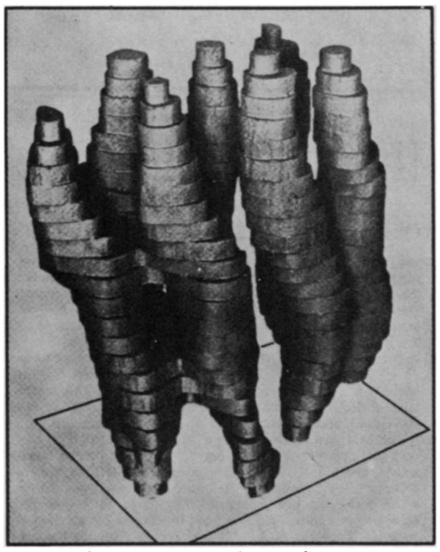
The discovery of a series of particles representing excited states of the basic J-psi indicate that it is a bound system of a particle and antiparticle. (Whether the constituents are a charmed quark and an anticharmed antiquark, as most theorists seem to have concluded, experiment doesn't say.) The pattern of observed excited states is similar to that for positronium, a bound system consisting of an electron and a positron. Also the J-psi is definitely a hadron, one of the large group of particles that responds to the strong interaction, the force that holds atomic nuclei together. "Unfortunately, this is all that can today be concluded from the experiments," Ting says.

And now, the MIT-Brookhaven experiment, which has produced more than 50 million pieces of data and for which Becker claims a sensitivity at least a thousand times that of any other in the United States or Europe, yields "no trace of any indication of charmed particles." In fact it gives evidence against charm.

If the charm hypothesis is true, then when charmed particles are produced in proton-proton collisions, the ultimate decay products should include about equal numbers of electron-kaon pairs and electron-pion pairs. In fact, the number of electron-kaon pairs was less than one percent of the electron-pion pairs.

So the MIT group concludes that the J-psi's are still very much an enigma, unexplained misfits in the world of subatomic particles. □

# Purple salt-lover captures the sun



NASA

*'Purple protein' high resolution map.*

Halobacteria are salt-loving cells that inhabit stagnant puddles and salt flats at the edge of tropical seas. They prefer the surrounding environment pickled—or nearly so—with salt concentrations approaching the saturation point. They turn water orange and red herrings red and turn sunlight into chemical energy on their "purple membranes." These bacteria are, all in all, very strange organisms.

The National Aeronautics and Space Administration is intensely interested in strange organisms. For years, NASA has funded research on life under extreme conditions. And now, with Viking speeding toward Mars, interest in unique life systems has doubled. *Halobacterium halobium's* "purple membrane" turns out to be the only living unit other than chlorophyll-containing systems that is capable of changing sunlight into chemical energy (photosynthesis). The bacterium, therefore, fits both NASA interests—it lives under extreme conditions and has a unique life system—and has been the target of NASA-funded research. Six biologists held a press conference Tuesday at the University of California at San Francisco to discuss recent advances in *H. halobium* research and the significance of this strange cell to scientists in medicine and agriculture.

Walther Stoeckenius, a cell biologist at UCSF, first discovered the purple membrane about five years ago. The bacterium generates patches of the purple membrane just under its cell wall when oxygen or nutrients grow scarce in the surrounding salt water. The proteins in the special membrane then receive photons of light and turn them into chemical energy that the cell can use to power its life functions until oxygen and nutrients build up again. The protein is called bacteriorhodopsin and is similar to the retinal pigment, rhodopsin, in human eyes. Stoeckenius and co-workers have "mapped" the structure of this protein at high resolution, and it is, at present, the only membrane protein so characterized.

Rhodopsin in the eye, he explains, functions as a photoreceptor and signal transducer, which translates light energy into nerve impulses, and uses stored chemical energy in the process. Bacteriorhodopsin, on the other hand, receives light, and during a series of proton (H+) exchanges, stores energy in the form of ATP to power the cell. The system is less efficient than chlorophyll-based photosynthesis, but it is simpler and may help researchers understand energy exchanges in other organisms. And the similarity between bacteriorhodopsin and rhodopsin has been a windfall for eye physiologists.

Other news conference participants were Richard J. Havel, Richard Lozier and Roberto Bogomolni of UCSF, and Harold P. Klein and Janos Lanyi of NASA Ames Research Center. They and others, studying the unique photosynthesis of *H. halobium*, hope that it will lead them to a more refined understanding of photosynthesis in plants and light reception in the eye, as well as preparing NASA for any strange new life mechanisms Viking may find on Mars. □

# CEQ: Water, air show improvement

Air quality in the United States has generally improved and the worst sources of water pollution are being effectively controlled, according to the sixth annual report to the President by the Council on Environmental Quality. Conditions for wildlife, however, are deteriorating in many areas, and a new appreciation of the dangers of environmental carcinogens is emerging.

In the five years since passage of the Clean Air Act Amendments, atmospheric concentrations of particulate matter have declined an average of 14 percent, and average sulfur dioxide concentrations have declined 25 percent, CEQ reports. Many urban areas are also showing improvement in ambient levels of carbon monoxide and photochemical oxidants (smog).

Water quality, measured by 87 monitoring stations, generally showed improvement, with no stations reporting "severe" conditions in 1974. By that year, 92 percent of all stations registered "good or fair" conditions (violation frequencies of less than 40 percent). However, eutrophication of lakes in the eastern states continues to increase, ocean dumping increased 20 percent in 1974 alone, and the statutory deadline for installing secondary sewage treatment will apparently not be met by most cities.