Theorists, considering psionic matter, decided by a large majority that the predicted property, charm, was at work there, but hidden charm, not explicit charm. As Vera Luth of the Stanford Linear Accelerator Center draws the picture, the consensus seems to be that the basic structure of psionic matter consists of a charmed quark and an anticharmed antiquark (thus exhibiting no charm overall). This configuration can exist at a number of different energy (or rest mass) levels. Each of the quarks possesses spin, and the system as a whole has angular momentum because the two quarks are seen as revolving around each other much like a binary star system or an "atom" of positronium. Changing the direction of either or both quark spins, adding energy to the system's angular momentum or any combination of those processes will yield a new rest mass and define a new member of the psionic family.

Two main points make theorists suspect that charm is at work in this picture. One is the comparatively long lifetimes. The heavier particles in physics usually decay by means of the strong interaction. Strong decays go fast, and hence, the particles have short lifetimes. But according to the hypothetical rules for charm laid out by the theorists, the total amount of charm should be conserved in strong decays. That means the most plausible strong decay for the psi particles would be into a pair, one of which displayed charm and the other anticharm. The problem is that the lowest-mass psi came in at about 3,100 million electron-volts (3,100 MeV). For it to decay by the strong interaction there would have to be particles exhibiting charm and anticharm at about half its mass. Particle searches around 1,500 MeV have been many and thorough, but nothing of the kind is known. Therefore the low-mass psi's, if they decay at all, must resort to the weak interaction, which by hypothesis does not conserve charm, and weak decays mean long lifetimes.

The second point is that if the psi particles form a succession of states of the same basic structure with higher and higher masses, the higher ones ought occasionally to pass to lower ones simply by giving up the excess energy in the form of photons or quanta of electromagnetic radiation. Such occurrences have been observed in more than one laboratory.

All this leads both theorists and experimentalists to believe, as Min Chen of the Massachusetts Institute of Technology puts it, that some new quantum number is hidden in the behavior of psionic matter. But Luth cautions that there is no direct evidence that that quantum number is charm or at least charm as the theorists have postulated it. If experimentalists use the word, she says, it is because it is ready to hand and somewhat plausible.

What would clinch the case is the discovery of a particle or particles that show explicit charm and are related to the psi's. If there are none at energies much under 4,000 MeV—and nobody has found any—maybe they exist at higher energies. Kenneth Stanfield of Purdue University, who represents an experiment at the Fermi National Accelerator Laboratory that began looking for charmed particles before the discovery of psionic matter, says that even though the Fermilab equipment can search higher energies than other setups, no such animal has yet been seen. Luth and Chen, representing the experiments that originally found the J/psi, concur. No one anywhere else has put forth a solidly regarded claim.

So what to do? The first thing is to go on searching at higher and higher energies. Another possibility is to look for rare phenomena. Chen points out that perhaps an overtly charmed particle signifies its presence by an unusual mode of decay, a three- or four-body decay that nobody has yet thought to examine the data for.

One can also rethink the theory in part or in whole. Perhaps the theory is wrong about charm, says Chen. Or maybe, he speculates, charm is like magnetic poles: Charm and anticharm must always appear bound together like north and south poles, and there is no way to break them apart. Cut a magnet in half and you get two new magnets, not separated north and south poles. That may be what psionic matter is trying to teach us about charm. □

# Academy calls for freedom of inquiry

Apparently responding to reports of scientists being persecuted in the Soviet Union and other countries, the National Academy of Sciences last week issued a statement calling for worldwide freedom of inquiry and expression, and invited others to join in the declaration. Copies of the statement are being widely distributed, and the Academy will keep a file of those responding. It is not yet clear what actions will be taken to see that the supposed perpetrators of repression get the message.

Affirmation of the statement came at the Academy's annual meeting, following a strongly worded address by NAS president Philip Handler. "The Academy must learn its own mind in these matters," Handler said, and "must decide whether it has a responsibility or obligation to speak to violators of the human rights of scientists or other intellectuals wherever these may occur." He said it must also decide whether to use exchange programs with Communist countries as leverage in pursuit of these principles.

The Academy has received numerous requests to remonstrate Soviet officials, Handler said. Complaints have alleged that scientists have been exiled and jailed, have lost position and professional status and have been refused permission to emigrate. He said that from South America, too, have come reports of physical abuse of scientists and intellectuals.

The statement signed by Academy members does not attack these abuses directly, but rather calls for basic freedom to conduct and report research without fear of retribution. The search for knowledge, it says, should be conducted "without religious, political or ideological restriction." Discoveries and ideas should be freely disseminated, and those engaged in these pursuits should be free to travel and publish. The resolution also reaffirms the concept of personal, as well as professional, freedom, "upholding a universal belief in the worth and dignity of each human being."

One interesting consequence will be to see the reaction of those in this country who claim to have lost professional standing for holding unpopular views. The resolution specifically states, "Those who challenge existing theory must be protected from retaliatory reactions."

The final importance of the document, of course, will rest in what action is taken on it during negotiations, either by the Academy or the State Department, and what sanctions are imposed. Past decrees have had little effect in this arena. □

# One for the optimists

A new report from Herman Kahn's Hudson Institute provides an optimistic counterpoint to the gloom-sayers. The world, it concludes, is now entering the period of fastest economic growth in its history, during which population will be brought under control and the gap between underdeveloped and industrialized countries will be closed.

These conclusions are contained in *The Next 200 Years—A Scenario for America and the World,* which directly contradicts the conclusions of *The Limits of Growth,* an earlier study produced by the Club of Rome. Rather than having economic growth stop, for fear of pollution or starvation, Kahn would have the development process speed up. "The gap between the rich nations and the poor nations is the strongest force in making the poor nations richer," he says. Already the economies of the underdeveloped nations are growing twice as fast as did America's pioneer society, and technology transfer will facilitate the development process.

By 200 years from now, the report predicts, the population of earth will have leveled off at about 15 billion people, and per capita income will have risen from $1,300 to $20,000 (constant 1972 dollars). Coal will be adequate to fulfill energy needs until such "perpetual" sources as fusion and ocean thermal energy are available, and new agricultural techniques can overcome the threat of famine. □