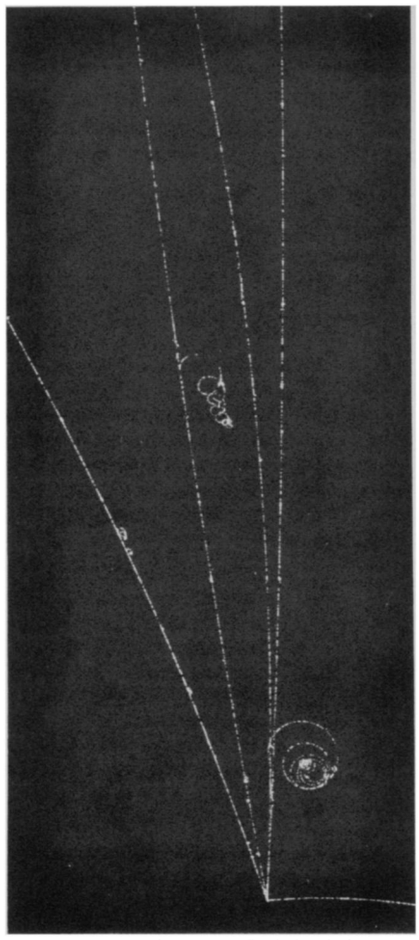

Lawrence Berkeley Laboratory

Creation and decay of the rho prime.

Rho prime's momentary flash of existence

Physicists know about four forces: the strong interaction which holds nuclei together, the electromagnetic force that holds atoms together, the weak force that causes radioactive decay and the force of gravity. During the last few years, particle physicists have been trying to understand the relationship between these forces—in particular between the electromagnetic and strong forces. For example, a proton sometimes acts as a neutron. About one percent of the time, light (photons), an electromagnetic force, acts as a strong or nuclear force.

When photons act this way they are called vector mesons or heavy photons. Three such mesons—the rho, the omega and the phi—had already been observed. Some theorists, however, thought these three were not enough to account for all the known strong interactions between photons and particles.

Now after three and a half years of work at Lawrence Berkeley Laboratory and the Stanford Linear Accelerator, scientists have found a fourth such vector meson called rho prime. The discovery confirms the hint of such a meson in a European experiment (SN: 9/23/72, p. 200).

The rho prime is one of a class of particles called resonances that decay into daughter products before they have been completely formed as parents themselves. This makes them extremely difficult to find.

The group, including Arthur H. Rosenfeld, George B. Chadwick, George P. Yost and G. Smadja, produced the rho prime by colliding a laser beam with a burst of electrons moving at nearly the speed of light. The laser beam bounced off the electrons in the form of gamma rays (photons) of energies of 10 billion electron-volts. While passing through a hydrogen-filled bubble chamber, some of the gamma rays became *virtual* rho prime vector mesons. In other words, they acquired the properties needed to react strongly with hydrogen nuclei (protons), but still lacked the mass to be real mesons. Somehow, in the collision with the protons, the *virtual* rho primes acquired mass to become real rho primes. Physicists do not fully understand how they acquired this mass. "The rho primes had mass breathed into them," Yost said at last week's meeting of the American Physical Society.

The rho prime is so far the shortest-lived known subnuclear particle. In the experiment, it decayed in 10^{-24} seconds (a millionth of a billionth of a billionth of a second) to form a rho meson and an epsilon meson. Each of these in turn decayed into a negative and a positive pi meson, making in all four pi mesons. This last mode was surprising, says Yost. Physicists had expected decay into only two pi mesons, which may have been one reason they had not been seen before. It was these longer-living pi mesons that were found by the team after scanning two million photographs.

The discovery opens the possibility that there are a limitless series of such vector mesons. □

Making the female mind feminine

A basic contention of women's liberation groups is that Adam and Eve were equals—mentally and psychologically if not biologically—until someone started forcing frilly feminine ideas into Eve's head. Society, say the feminists, has created the female stereotype and perpetuates it through a variety of institutions. A study by Phebe Cramer and June Bryson of Williams College in Massachusetts documents these charges and demonstrates how soon ideas of femininity begin to develop in young girls.

Because sex-role teaching pervades our culture, the researchers say in the January DEVELOPMENTAL PSYCHOLOGY, it is not easy to find a basic measure of sexual orientation. In the area of fantasy, however, gender identity is not dependent on obvious cultural stereotypes. Asking a young boy what he wants to be when he grows up will usually produce the expected answer—cowboy, fireman, doctor, etc. Girls will say teacher, nurse or mother. But fantasies can be rated on form as well as content. Adult males, for instance, when asked to tell an imaginative story typically begin with a series of positive experiences or emotions, reach a climax or turning point and end with experiences or emotions of a negative tone. This pattern is characterized as enhancement followed by deprivation. The typical adult female pattern, on the other hand, is deprivation followed by enhancement.

The researchers investigated fantasy patterns in two groups of children. One group consisted of 48 nursery, kindergarten and first-grade children (23 males and 25 females). The other was made up of 41 third-, fourth- and fifth-grade children (20 males and 21 females). Each child was asked individually to tell stories to four pictures, presented one at a time. All stories were transcribed and scored by independent raters who knew neither the sex nor age of the storyteller.

For the older children there was a clear difference, as expected, between the fantasies of males and females. Similarly, a comparison of younger with older girls showed a significant difference. The fantasy ratings of younger boys and girls, however, were almost indistinguishable as were those of the younger and older boys. These results, say the researchers, provide strong support for the hypothesis that boys and girls, at the time they enter school, do not show the sex-related patterns of fantasy that have been found to differentiate the adult men and women. But by the time they reach fifth grade the psychological differences between males and females, as evidenced by the fantasies, are clearly developed.

The way in which this psychological change comes about is particularly interesting. All children start off with the same basic orientation. The males apparently retain that pattern while the females change. This can be interpreted in several ways, the researchers conclude. It could mean that the masculine pattern is set at the age of entering school and there is no further development. It could also mean that the social reinforcements and pressures applied to females are stronger and force them to change their way of thinking. □