NOW YOU SEE IT . . .

The split in the A_2 meson

The A_2 meson is one of the extremely short-lived particles called resonances that make fleeting appearances in the collisions and other activities of longer lived particles. Or perhaps the A_2 meson is two resonances, differing in mass by something like 40 million electron-volts (MeV), but otherwise presumably twins.

As a single particle, the A_2 would neatly fit the quark theory of elementary particles, according to which each particle is made of two or three subentities called quarks. A split A_2 would not fit, and to accommodate it theorists have resorted to more complex and exotic suggestions in which larger numbers of quarks come into play (SN: 11/1/69, p. 410).

Evidence that the A_2 is two particles and not one was first presented in 1967 by a group of experimenters from the CERN laboratory at Geneva led by Dr. Bogdan Maglić, now at Rutgers University. Experiments since then have either found or not found the division. Most prominent on the negative side are one from the Lawrence Radiation Laboratory referred to as LRL Group A, one done by a group from the staff of Brookhaven National Laboratory for which Dr. S. J. Lindenbaum is the spokesman and one done at Brookhaven by a group from Northeastern University and the State University of New York at Stony Brook for which Dr. Bernard Gottschalk of Northeastern is the spokesman.

The debate has become so lively that the American Physical Society scheduled a symposium on the topic during its meeting in Washington last week.

The discussion was spirited and sometimes acrimonious. Both sides went into it convinced of the rectitude of their positions. New results pro were reported by a group from the University of Bologna led by Dr. A. Zichichi, and new results con by a group from the Max Planck Institute in Munich and CERN led by Dr. P. Weilhammer. Opponents and proponents of the split came out of the symposium maintaining their positions. Uninvolved observers seem to be mostly holding their judgment a while longer.

The argument begins with the number of experiments that can be claimed as independent measurements of similar authority. In Dr. Maglić's arithmetic there are 24 experiments, of which 16 record the split and 8 do not. Dr. Lindenbaum replies that the "experiments Bogdan refers to are not remotely in league with these two [Brookhaven and NE-SUNY] and the ones presented today, and he should cross out that slide [showing the 24] but he won't."

A further level of debate is an argument over experimental procedures. Resonances are too short-lived to be directly detected in particle counters the way protons or electrons, for example, can be. What everybody does is to measure the energy and momentum of the particles going into some interaction and of the particles coming out and deduce from these data the existence and characteristics of the resonance.

Dr. Maglic used what is called a missing-mass spectrometer. The experiment sent a beam of protons against a target that would produce A_2's. The experimenters knew what went into the collision, and they measured the energy and momentum of the recoil proton that came out. From this they deduced the missing mass in the interaction, that of the A_2 meson.

The Brookhaven group experiment was done by a technique that measured the decay products of the A_2. According to Dr. Lindenbaum, it could more accurately bracket the characteristics of the A_2.

The Northeastern-SUNY experiment was designed to be equivalent to Dr. Maglić's. It is not exactly similar, says Dr. Gottschalk, but it is close enough that "the two experiments confront each other directly." It is this confrontation that makes the Northeastern-SUNY experiment the clincher in Dr. Lindenbaum's view. There are many pitfalls in the missing-mass technique, says Dr. Lindenbaum, and he believes that the Northeastern-SUNY group did a better job of avoiding them than Dr. Maglić did.

The Northeastern-SUNY group also claims better statistics through measuring more events. Critics of Dr. Maglić ask whether he has recorded enough events above the random background to be sure that the dip in the graph that plots the number of particles recorded versus their mass is really the separation of two particles rather than a statistical fluctuation. Pointing to his own data Dr. Gottschalk says: "This is the little squiggle that Prof. Maglić has elevated into a dip. It is a perfectly respectable statistical variation. Except at the peak [where the dip is] our data are not inconsistent with CERN's."

Dr. Maglić replies that his opponents' methods are not as discriminating as his. They are not as able, he suggests, to distinguish small differences in mass, and therefore they could make two particles of nearly the same mass look like one.

Finally the argument descends to the level of mistakes pure and simple. Dr. Maglić talks of "fudging" in reference to his opponents' arguments. Dr. Lindenbaum responds with remarks about "freshman mistakes."

In all, the controversy is conducted with a heat unusual for public debates among physicists. Dr. Giorgio Salvini of the University of Rome, who read the report of the absent Dr. Zichichi, but who says, "I am not an A_2 man myself," sees a reason. "They are fighting for their lives," he says. If any of them can be convicted of a mistake, he will experience difficulties in getting future opportunities for experiment, and in a time when money is scarce, this could be fatal to his career. □

AMBIENT AIR STANDARDS

Cities face decisions on autos

Most of the public discussion before and even after passage of the 1970 amendments to the Clean Air Act was focused on the 1975 and 1976 emission standards for automobiles. Relatively neglected was the possibility that national ambient air standards called for in the amendments would demand a fairly drastic restructuring of urban transportation (SN: 12/26/70, p. 477).

William D. Ruckelshaus, administrator of the Environmental Protection Agency, last week announced standards set for six pollutants under the 1970 amendments. The one that may require changes in urban transportation: a limit of 9 parts per million of carbon monoxide as a maximum 8-hour concentration.

According to Ruckelshaus, seven cities—New York, Chicago, Los Angeles, Denver, Philadelphia, Washington and Cincinnati—will probably not be able to meet the standards if they allow today's unrestricted use of automobiles. The only apparent alternative is building rapid transit systems and limiting the numbers of automobiles that enter the cities.

The other standard that will cause some cities problems is the 1.03 parts per million limit on sulfur dioxide on an annual mean basis. New York, Chicago, St. Louis, Baltimore, Philadelphia, Hartford and Buffalo all have coal- or fuel oil-burning power plants and other industries that cause this level to be exceeded. One alternative appears to be use of natural gas, but reserves are growing smaller. Natural gas substitutes made from coal may be a major long-run answer, but programs for developing them are presently underfunded (SN: 3/13/71, p. 177).

States have a year to work out plans —which have to be acceptable to EPA— for meeting the new standards, then three years to meet them. □