

A2 splitting

Whether the A2 meson has a split personality has been a source of controversy for the past five years. (Enthusiasts who would like to go over the history could try vol. 10 page 272, vol. 9 page 233.)

A series of observations at CERN in missing mass experiments have indicated very clearly that the peak associated with the A2 meson at a mass of about 1300 MeV is split into two component parts suggesting that two particles of almost identical mass and identical quantum numbers are interfering with one another. This result has stimulated a variety of theoretical speculations and explanations — ranging from a freak accident of nature to fundamental new ideas on the scheme of elementary particles.

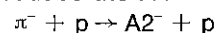
The missing mass experiment which produced the negative A2 meson,

carried out with a low momentum pion beam on a hydrogen target, has been repeated several times with different experimental techniques and different apparatus. Each time the A2 has come up very clearly as split. This observation was supported for the neutral A2 meson in another experiment at CERN reported last autumn at the Kiev Conference.

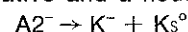
Meanwhile, however a Berkeley bubble chamber experiment looking at the positive A2 meson has shown no sign of splitting over a similar momentum range. Two new experiments looking at the negative A2 at much higher momentum have now come down on the side of no splitting.

The first result came from a CERN-Munich team (G. Grayer, B. Hyams, C. Jones, P. Schlein, W. Blum, H. Dietl, W. Koch, H. Lippmann, E. Lorenz, G. Lütjens, W. Männer, J. Meissburger, U. Stierlin, P. Weilhammer). It was announced at a CERN seminar last

December and was published in Physics Letters, 1 March. They used a negative pion beam of momentum 17.2 GeV/c from the proton synchrotron onto a hydrogen target 50 cm long to produce the A2



and detected the A2 through its decay into a negative and a neutral kaon

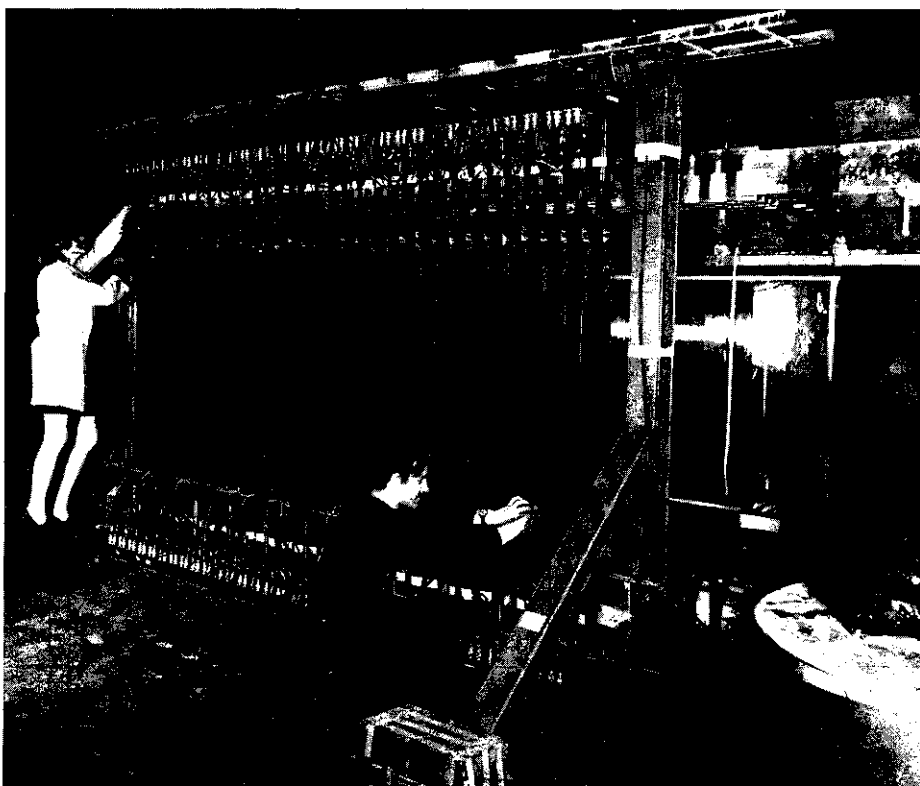
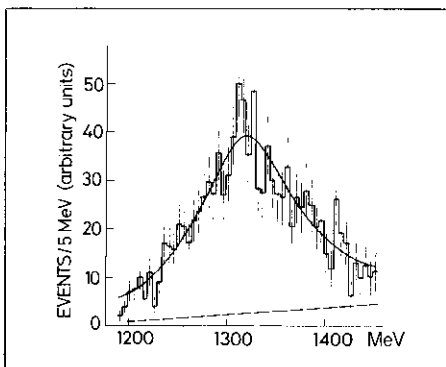


A total of 1934 events were counted in the mass range between 1000 and 2000 MeV with a mass resolution of ± 5.7 MeV at the position of the A2 meson around 1300 MeV.

The particles involved in the interactions were detected in wire spark chambers with magnetostrictive read-out (24 planes identifying the incoming pion, 24 planes recording the charged particles emerging from the target), a spectrometer magnet with a 1.5 m wide aperture 0.5 m high and a bending power of 2 T m, and a further 24 wire planes recording trajectories

Right: The picket fence of scintillation counters used in the triggering system of the CERN-Munich experiment which has reported no splitting of the A2 meson. Behind the fence can be seen the last of the magnetostrictive wire chambers and behind the chamber is the large aperture spectrometer magnet.

Below: The A2 peak as detected via the negative and neutral kaon decays of the meson. There is no sign of the two peak structure reported in previous experiments.



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The niobium-titanium outer coil for the HYBUC bubble chamber photographed during the final stages of winding in the USA. The completed magnet has now been assembled and successfully tested at CERN.

after the magnet. Cherenkov and scintillation counters completed the particle identification system. With a pion beam of 4×10^4 particles an average of 2.5 events per PS pulse was recorded. No sign of A2 splitting emerged from the data and there was no sign of splitting dependence on momentum transfer which, at the time of the Kiev Conference, had seemed a possible way of reconciling the previous Berkeley and CERN results.

A result from Brookhaven emerged at the American Physical Society in February to support this conclusion (K.J. Foley, S.J. Lindenbaum, W.A. Love, S. Ozaki, E.D. Platner, A.C. Saulys, E.H. Willen published in *Physical Review Letters*, 15 February). They studied exactly the same interaction sequence with an incoming pion beam from the AGS at a momentum of 20.3 GeV/c. They also used a large aperture magnetic spectrometer and wire chambers as detection

system. Their data (564 events) within the mass region 1200 to 1400 GeV, shows no sign of a splitting of the A2.

At the Kiev Conference the splitting of the A2 was taken as well backed by experimental evidence and the problem was to find the theoretical explanation. Now it looks probable that the A2 has returned to the fold of its brethren in the spin 2 multiplet as a single peak broad resonance. The problem is to understand the source of the narrow peaks in the A2 region found in the missing mass experiments.

HYBUC magnet success

The superconducting magnet for the hyperon bubble chamber, HYBUC, was taken above its design field of 11 T when it was tested at the end of February. The achievement of such a high field during the first complete

test of the magnet could possibly hold a technological message of importance for the future of superconducting magnets.

The HYBUC story was told in vol. 10, page 353. Recapping briefly, it is a small hydrogen bubble chamber specifically designed for the measurement of the magnetic moments of hyperons (beginning with the sigma hyperon in an experiment to be carried out by a team from the Max-Planck-Institut für Physik, Munich, and members of the Niels Bohr Institute, Copenhagen, and Vanderbilt University, USA). Tests on the chamber itself yielded the first photographs of particle tracks at the end of last year (see vol. 11, page 15).

At the end of January the superconducting magnet, which has been built in the USA, arrived at CERN and was installed in the HYBUC vacuum tank. The magnet is technologically the most interesting feature of the chamber assembly. It is designed to produce a very high field (11 T) on the horizontal axis of the chamber — the higher the field the greater the effect on the hyperon via its magnetic moment.

The magnet consists of a set of outer coils, constructed using niobium-titanium as the superconductor, with 280 mm inner diameter, designed to give at least 7 T on the axis. Within the bore of these coils is another coil (178 mm inner diameter) using niobium-tin as the superconductor which is designed to add up to 5 T to the field on the axis. The useful chamber volume sits within the horizontal bore of the niobium-tin coil. (A further shorter niobium-titanium coil, which produces field in the opposite direction to the main magnet, serves to reduce the effect of the main magnet field on the incoming particle beam.)

The first time that the magnet was powered under conditions suitable for

