

Warsaw conference

Preliminary report

They came to bury the Standard Model, not to praise it, but at the end of the year's major high energy physics jamboree, the 28th 'Rochester' conference, held in Warsaw from 25-31 July, the Standard Model was in its best shape for years.

The Standard Model is a 20 year old collection of theories which has enjoyed remarkable success, agreeing with experiment to extraordinary precision. But recently, a few small cracks have appeared. Physicists came to Warsaw eager to hear of widening gaps between experiment and theory, but left with the message that the cracks have disappeared.

First to go was the so-called R_b anomaly. R_b is the fraction of quark producing Z decays producing pairs of heavy b-quarks. Last year, results from CERN's Large Electron-Positron Collider, LEP, seemed to indicate that this happened far too often (October 1995, page 1). The most promising explanation involved supersymmetry, a theory linking particles and forces which introduces a new 'supersymmetric' partner for each ordinary particle. In this model, the Z can decay into supersymmetric particles, which in turn decay to b-quarks, but even this could not explain an effect as big as that seen at LEP.

At Warsaw, the Aleph and L3 experiments presented new R_b values closer to the Standard Model prediction. The Aleph result matches precisely at 21.58%, but the new world average is still uncomfortably high at 21.78%. The mood of the conference was one of wait and see, but supersymmetry enthusiasts pointed out that the new world average is exactly what their model anticipates.

Another apparent deviation from the Standard Model appeared at Fermilab's Tevatron proton-antiproton collider last year, when the CDF experiment observed an excess of high transverse momentum jets. The Tevatron's other experiment, D0, did not see the same effect. In Warsaw, Raymond Brock showed the CDF and D0 data to be entirely consistent, and suggested that the effect arises from the models used to interpret the data, in particular, the description of gluons inside the proton. Brock's conclusion that more information is needed about the gluon was a recurring theme of the conference.

Summarizing recent spectroscopy results, Rolf Landua said that a particle made only of gluons, a glueball, is now established, but it is not yet possible to say which of two particles it is. Sergey Levonian and Halina Abramowicz both drew attention to the Pomeron, much in vogue in the 1970s for understanding elastic scattering and now making a comeback. Data from the Zeus and H1 experiments at HERA in Hamburg continue to show the structure function of the proton, which measures the momentum distribution of the proton's constituents, to rise sharply at low momentum fraction.

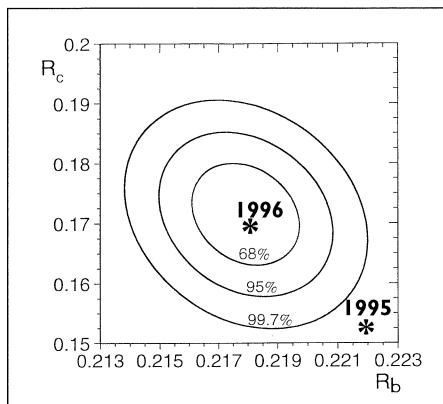
This phenomenon, according to Levonian, could be accounted for by a Pomeron with a large gluon content.

The Warsaw conference was the first Rochester to feature all the Standard Model particles in their place, with the top quark now in the physics mainstream. Paul Tipton presented the latest value of the top mass as 175 ± 6 GeV, paradoxically making it the most accurately measured quark mass of all.

Giving a taste of things to come, Alain Blondel showed the first events from the new high energy LEP2 (see page 15), and Yoshiro Suzuki reported that Japan's Super Kamiokande neutrino detector is working well, having started data taking on 1 April (July, page 22).

Closing the conference, Gabriele Veneziano of CERN concluded that "The Standard Model's health, already excellent, keeps improving as it gets rid of a little cold, or a small headache."

(A full report of the Warsaw conference will appear in next month's issue.)



One of the cracks in the Standard Model, the fraction of Z particles decaying to b-quarks (R_b) or c-quarks (R_c) has almost disappeared. The contours show statistical levels of confidence around the new result (1996). Last year's values (1995) are plotted in the bottom right hand corner.