

A matter of quarks

Quarks are understood to interact through the 'colour' force, carried by gluons. Under normal conditions these quarks are confined – frozen together in 'colourless' states such as protons, neutrons and other strongly interacting particles. However if the quarks are compressed tightly together and/or are 'heated' by increasing their energy, they should eventually break loose from their colour bonds to form a new kind of matter – the so-called quark-gluon plasma. Although QGP has not yet been synthesized in the Laboratory, it was most likely the stuff of the Universe 10^{-5} second after the Big Bang. Thus the search for this 'new' matter is attracting a growing number of physicists, theorists and experimenters from both the particle physics and nuclear physics fields.

Theorists confidently predict QGP formation in the collisions of heavy nuclei at energies available from present machines, so that a glimpse of these post-Big Bang

conditions might come soon and relatively cheaply.

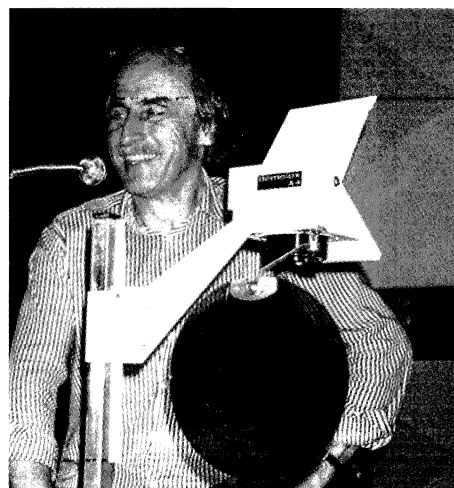
With this in mind, the 1987 Quark Matter Conference, held from 24-28 August at Schloss Nordkirchen, near Dortmund, West Germany, focused on the first results obtained last year with nuclear beams in experiments at CERN and Brookhaven. CERN provided higher energies (oxygen nuclei at 60 and 200 GeV per nucleon) while Brookhaven offered heavier nuclei (silicon at 14.5 GeV per nucleon).

At CERN, four major detectors collected data from the oxygen run last year – the WA 80 'Plastic Ball' study, the NA34/2 HELIOS detector, the NA35 streamer chamber experiment, and the NA38 muon pair spectrometer (see December 1985 issue, page 429). This year's run at CERN used the heavier sulphur nuclei to increase the energy densities, and two more major experiments joined the fray – the NA36 Time Projection Chamber and the WA85 group using the Omega spectrometer. In both runs, smaller experiments using special targets ran in parallel. Complementary results came from two Brookhaven studies (Experiments 802 and 814 – see April issue, page 18).

The first workshop on quark matter physics was held in Bielefeld in 1982. Since then periodic meetings have reflected the increasing enthusiasm and confidence in this new physics venture, but this year was the first time that experimental results were available.

It is not yet possible to say if the quark-gluon plasma has been synthesized under laboratory conditions. Maybe the Brookhaven energy is too low and perhaps the CERN nuclei are too small. Yet there are two intriguing clues. The

Quark Matter announcement from Reinhard Stock, chairman of the organizing committee at the August meeting at Schloss Nordkirchen, near Dortmund.



NA38 team reported a suppression of the J/psi resonance in the di-muon spectra from oxygen-uranium collisions producing large transverse energy, while Brookhaven saw five times as many charged pions as kaons. Both these effects had been predicted as indicators of QGP.

Results from the other CERN experiments' 1986 oxygen run can be explained by conventional ordinary nuclear effects. However the 'stopping power' of the incoming nuclei under these conditions is found to be as high as had been hoped, so that a lot of energy (a few GeV) can be compressed inside a nucleon-like volume. This is just what is needed to make QGP, and experimenters are looking forward eagerly to the final analysis of this year's sulphur run.

As well as looking at initial results, the Schloss Nordkirchen meeting looked forward to future projects. Brookhaven has its RHIC Relativistic Heavy Ion Collider plans well advanced, while at CERN attention is turning to the possibility of a dedicated pre-injector providing lead nuclei. US prospects were described by D. Hendrie (Department of Energy), and Pierre Darriulat covered the CERN side.

CERN *From oxygen to sulphur*

For several weeks during September and October, the CERN accelerators handled sulphur 32 ions, with the SPS synchrotron boosting them to 200 GeV per nucleon. This set up a new world beam energy record of 6400 GeV (6.4 TeV), doubling the figure set at CERN last year with oxygen 16 ions. With interesting clues emerging from the 1986 data, the first results from the sulphur beams are eagerly awaited.

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The meeting, organized by R. Santo (Munster), H. Satz (Bielefeld / Brookhaven), H. J. Specht (Heidelberg) and R. Stock (Frankfurt, chairman), brought together about 250 physicists. The next conference in the series will be held next September on the US East Coast.

E. Feinberg (Lebedev Institute, Moscow) sings the praises of the hydrodynamical approach to Quark Matter Conference organizing committee member Hans Specht of Heidelberg

(Photos M. Jacob)



Energy not the only frontier

The LEAR Low Energy Antiproton Ring – CERN trump card.

(Photo CERN X180.8.87)

While the push for big new machines to explore high energy frontiers makes the headlines, other avenues for physics progress are still being actively explored. To reflect these efforts, theorists and experimenters from the experiments committees for CERN's two major existing machines – the PS Proton Synchrotron and the SPS Super Proton Synchrotron – joined forces in study groups to look at long term physics perspectives. As one experimenter put it, 'there are frontiers of high complexity and high precision as well as high energy'.

The groups' findings were aired at a special joint open meeting of the two committees at CERN on 31 August and 1 September. Although organized in a CERN con-

