

CERN Courier Archive: 1969

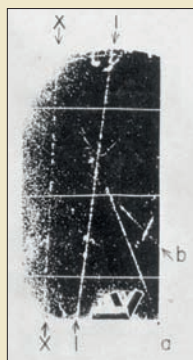
A LOOK BACK TO CERN COURIER VOL. 8, OCTOBER 1969, COMPILED BY PEGGIE RIMMER

AROUND THE LABS

Quark candidates in Sydney

A report, by a team from the Cornell-Sydney University Astronomy Centre, Australia, on a high-energy cosmic-ray search which seems to have evidence for quarks, appeared in *Physical Review Letters* on 22 September. A preliminary announcement was made at the 11th International Conference on Cosmic Ray Physics in Budapest, 25 August to 4 September, and on 8 September L S Peak, who participated in the experiment with L Cairns, R L S Woolcott and team leader C B A McCusker, spoke at CERN about their intriguing findings.

The postulate that the many strongly interacting particles are built from quarks, coming together in different ways, has been the most successful of the theoretical models which attempt to explain observations. However, all previous searches, both at particle accelerators and in low-energy cosmic rays, have failed to reveal a quark as a physical object. This does not necessarily mean that quarks do not exist – their mass may be too high for them to be produced at existing



A photograph of a "quark candidate" in high-energy cosmic-ray showers, taken in a Wilson cloud chamber by the University of Sydney team. The track (X-X) contains fewer droplets than its neighbours, suggesting the passage of a particle producing lower ionization.

accelerator energies. They may, however, occur in much higher-energy cosmic rays.

One of their unusual properties would be that they would carry a charge of $1/3$ or $2/3$ the unit charge of the electron. Once above a certain energy, the ionization that a particle produces as it passes through matter is proportional to the square of its charge, independent of its mass. This provides a rather clean handle to get hold of the quark.

Beginning in July 1968, the Sydney team looked at cosmic-ray air-shower cores with a detector consisting of lead-shielded scintillation counters triggering four Wilson cloud chambers at an energy above 10^{15} eV [10^3 TeV]. In a little over a year they recorded about 60,000 high-energy particle tracks and found five with ionization about half that of a normal particle.

Other possible sources of low ionization – such as a statistical fluctuation in ion production, the Chudakoff effect, poor illumination, clearing field present – have been eliminated, leaving the most likely source as the passage of particles carrying less than unit charge, possibly quarks of charge $2/3$.

The results have been greeted with guarded optimism. The Sydney group, obviously keen to provide more evidence, is constructing a larger detection system with high-pressure cloud chambers and streamer chambers, both sensitive to particle charge.

● Compiled from texts on pp307–308.

CERN NEWS

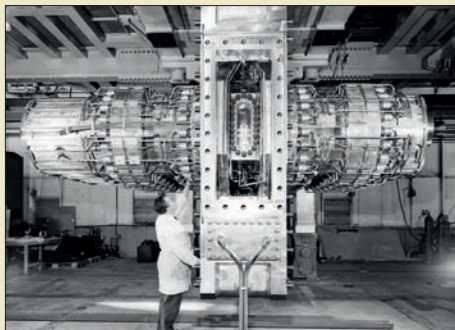
PS shutdown: the bubble chambers

The annual shutdown of the PS, 13 October until 26 November, allows work on the three bubble chambers in service at CERN. The 2 m hydrogen chamber has taken more than 3.8 million photographs between November 1968 and October 1969. On 6 September it

reached the total of 10 million photographs since it came into operation less than five years ago. The 81 cm hydrogen chamber took 1.9 million photographs in the same period, bringing its total close to 13 million since 1961. The 1.2 m propane chamber had taken 1.6 million, bringing its total to 7.5 million since 1960.

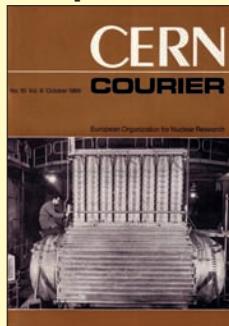
● Compiled from texts on pp301–304.

An unusual view into the 1.2 m heavy-liquid bubble chamber, which is also having a wash and brush up while out of action during the PS shutdown.



The 2 m hydrogen bubble chamber is undergoing modifications during the annual PS shutdown. For this, the two halves of the magnet, which normally hide the chamber, safety tanks, cooling pipes etc, are rolled back.

Compiler's Note



In the 1960s, bubble chambers were in their heyday at labs such as CERN, although cloud chambers still found some use. The quarks that were 'discovered' in the device in Sydney were soon being 'undiscovered', as *CERN Courier* reported in January 1970. Other groups should have seen similar events but did not. The events in Sydney were probably low-energy muons or tracks through a poorly illuminated part of the chamber.

Currently, we are enjoying a period of unguarded optimism concerning the appearance at the LHC of something resembling a Higgs boson, with an energy around 125 GeV. The full LHC collision energy of 14 TeV, not yet achieved, corresponds to a 10^5 TeV fixed-target proton beam or cosmic ray. Yet, cosmic rays can still trump that, reaching energies as high as 10^8 TeV.

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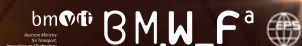
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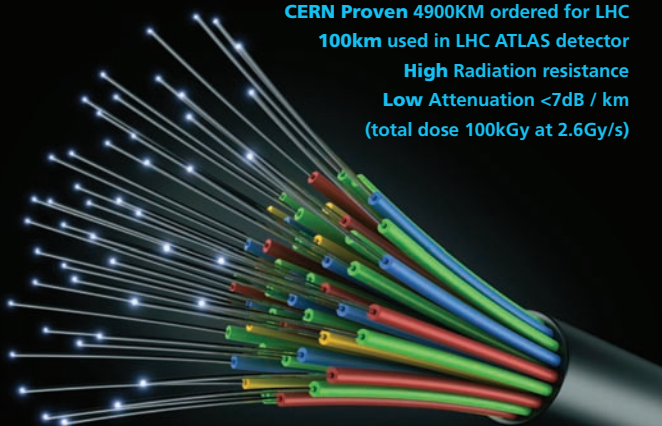
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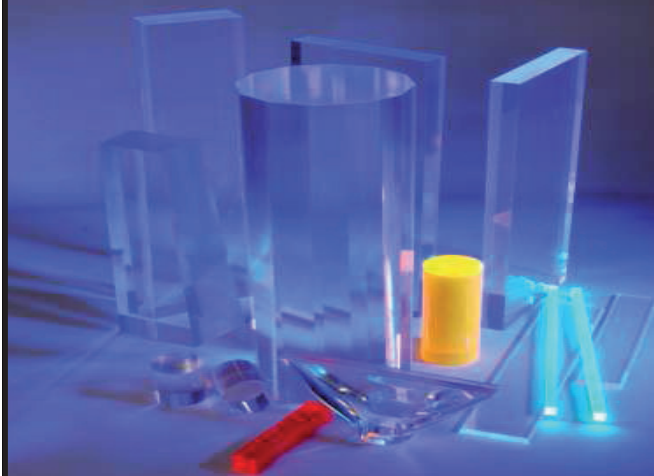


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