

The 100 metre vacuum chamber of the CERN/Dortmund/Edinburgh/Orsay/Pisa/Siegen group studying neutral kaon decays. The neutral kaon might still have more surprises in store.

(Photo CERN 288.6.84)

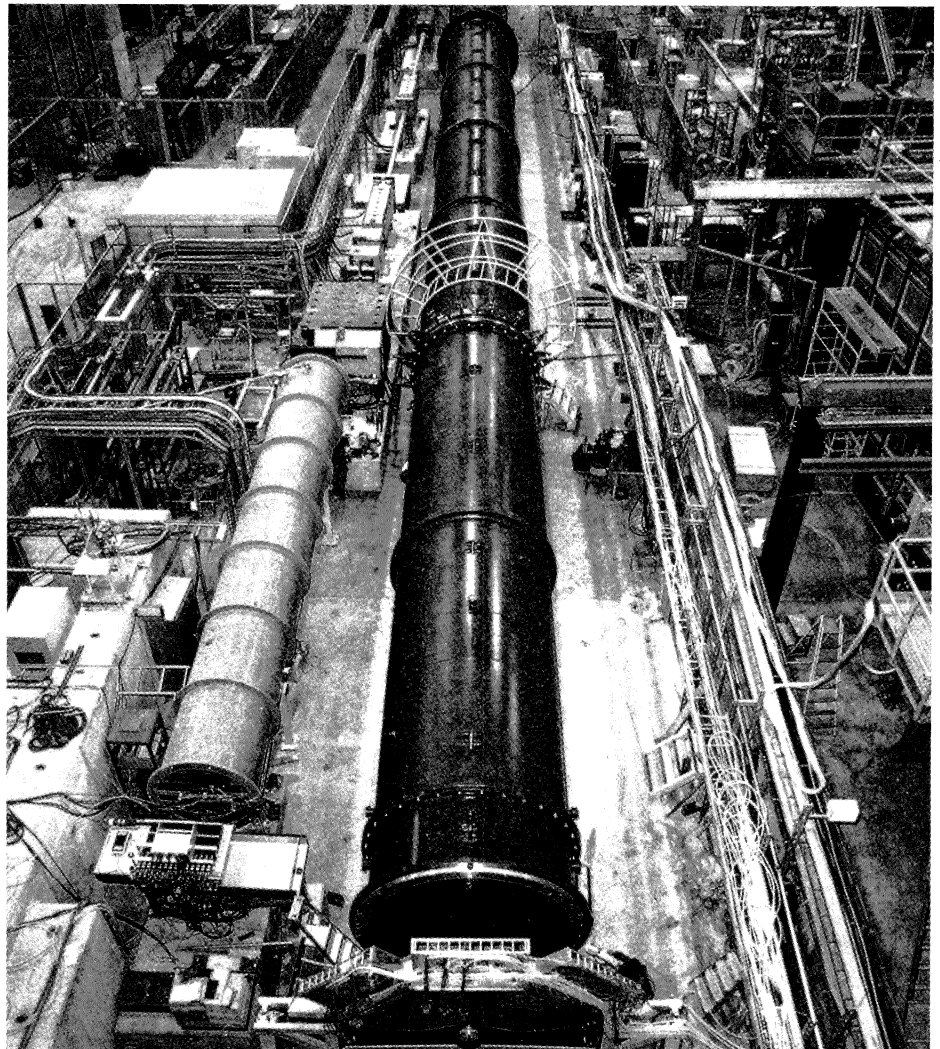
Force apart?

Electromagnetism, the weak nuclear force and the strong nuclear force, plus gravity, together cover all the conventionally known forces at work in Nature. Even after the triumph of the electroweak unification, which effectively reduced the number of fundamental forces from four to three, the dream of many physicists remains to unify them into one single picture.

Since the time of Faraday in the middle of the 19th century, this goal has been elusive. While excitement runs high that 'superstrings' (see June 1985 issue, page 185) could finally do the trick, there could yet be major obstacles to be overcome. Just as Faraday and Einstein's efforts at unification were handicapped by an incomplete knowledge of the forces at work, the present picture might still be incomplete.

This has recently been suggested by a US (Brookhaven/Purdue/Seattle) group, citing several clues. Firstly measurements of the strength of the gravity by geophysical (satellite, geological, marine, etc.) experiments give values consistently higher than those measured in the laboratory.

Secondly, the force of gravity should depend conventionally only on the mass and not the nature of a material, as Galileo demonstrated with the help of the leaning tower of Pisa. The classic (1922) studies by Eötvös using a precision torsion balance checked the uniformity of the gravitational pull on different materials to within a few parts per thousand million. However the idea now being put forward says that these tiny variations are in themselves significant.



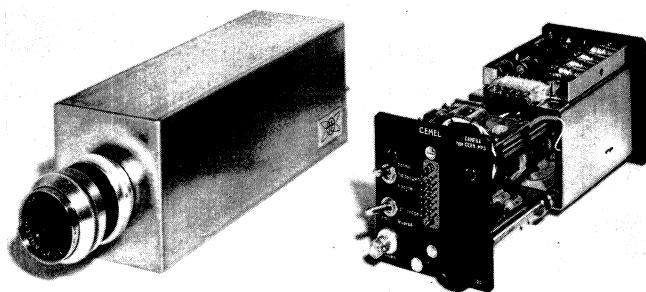
One way to allow for the apparent variation of gravity is to introduce an additional force dependent on hypercharge (the sum of baryon quantum number and the strangeness quantum number), a quantity which plays a role in the symmetry of strong interactions. The force would be brought about by the exchange of 'hyperphotons'.

The US group has pointed to hints of subtle variations in the neutral kaon parameters measured in experiments running under different conditions and which could be due to such a force.

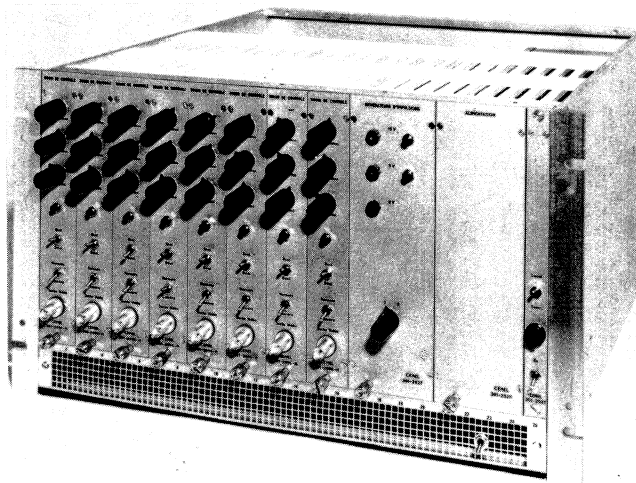
Several times in the short history

of particle physics the neutral kaons have been the scene of dramatic new discoveries which led to rapid reappraisals of current thinking. In 1956 it was realized that decays of the neutral kaons violated left-right symmetry and the hitherto sacred invariance of parity was overthrown. In 1964, the replacement symmetry of charge conjugation and parity (particle/antiparticle and left/right) too toppled.

Could it be that the neutral kaons hold the key to still more mysteries?



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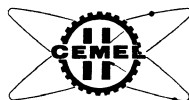
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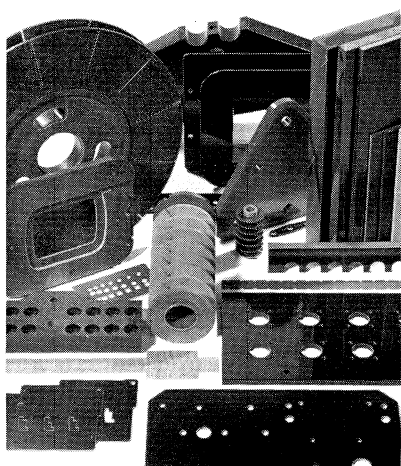
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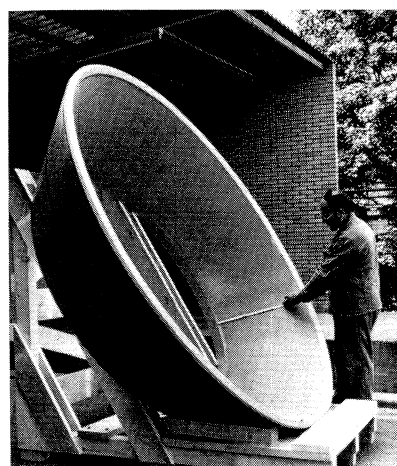
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