

(in 1975) was followed by several years of confusion and uncertainty about the validity of our data and its interpretation. It is hard to explain this confusion a decade later when we know that tau pair production is twenty per cent of electron-positron annihilation below the Z, and when tau pairs stand out so clearly at the Z.'

'There were several reasons for the uncertainties of that period. It was hard to believe that both a new quark, charm, and a new lepton, tau, would be found in the same range of energies. And, while the existence of a fourth quark was required by the theory, there was no such requirement for a third charged lepton.'

## Rare decays

With the Standard Model of particle physics currently looking impregnable, physicists are eager to look inside it to see what makes it work.

(The Standard Model uses the electroweak synthesis of electromagnetism and the weak nuclear force, loosely coupled with quantum chromodynamics – QCD – the contender field theory of quark interactions.)

One way of finding a crack to peer inside the Standard Model is to look for 'rare' decays (by rare, physicists mean processes forbidden or highly suppressed by well-known selection rules). This approach was highlighted in the recent Europhysics Nuclear Physics Conference in Bratislava, Czechoslovakia.

Searching for rare decays needs special detectors, and Nobel Laureate R. Mössbauer opened the meeting with a talk on low temper-

ature radiation detectors, a theme taken up by K. Pretzl, A. Giuliani and L. Gonzales-Mestres (September 1988, page 23). These devices will go on to play a major role in the search for the invisible 'dark matter' thought to make up much of the Universe.

The meeting was a convenient shop window for the new 17 keV neutrino results (see page 9). Also in the neutrino sector, several speakers reported new results from attempts to measure the mass of the electron-type neutrino in the beta decay of tritium. The lowest limit, 9.4 eV, came from experiments using free molecules, reported by T. Bowles from Los Alamos, while a solid tritium source, reported by S. Shibata from INS Tokyo, gave a 13 eV limit.

Double beta decay accompanied by two neutrinos, first reported in selenium-82 several years ago (January/February 1988, page 32), is now well established, and measurements were reported at Bratislava from germanium-76 (F. Avignone, S. Carolina, and I. Kirpichnikov, ITEP Moscow) and for molybdenum-100 (M. Moe, UC Irvine, and H. Ejiri, Osaka). With half-lives between  $10^{19}$  and  $10^{21}$  years, these are the slowest processes seen in Nature.

The search continues for neutrinoless beta decay, the best limits so far coming from germanium-76, reported by D. Caldwell, Santa Barbara, and F. Avignone.

Possibilities for neutrino mixing, which could help explain existing neutrino puzzles, were reviewed by S. M. Bilenky, pointing out that existing data cannot exclude the possibility of visible neutrinos being superpositions of three light varieties and one heavy one.

The relative probability of a pion decaying into an electron, rather

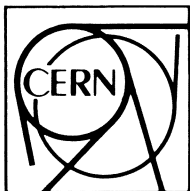
than a muon, was reported as  $1.223 \pm 0.004 \times 10^{-4}$ , slightly different to the calculated value, according to G. Czapek of Berne. A search for muon-electron conversion at the SINDRUM detector at the Swiss PSI Laboratory gave an upper limit relative to muon capture of  $4.4 \times 10^{-12}$ , said W. Bertl of PSI.

The meeting was organized by the Board of the Nuclear Physics Division of the European Physical Society (EPS), by the Union of Slovak Mathematicians and Physicists and by Bratislava University. It was the first time that an EPS Nuclear Physics Division Conference had been organized in a former socialist country. The proceedings will be published as a special issue of *Journal of Physics G: Nuclear and Particle Physics*.

*From Pavel Povinec*

*At the recent Bratislava meeting on Rare Decays, S.M. Bilenky of Dubna talked about the implications of neutrino mixing.*





# How to visit CERN

## Comment visiter le CERN

Organized visits take place only on Saturdays, at 9.30 a.m., and/or 2.30 p.m. The visits last about three hours and are free. The minimum age limit is 16 years.

Les visites commentées ont lieu seulement le samedi à 9 h. 30 et/ou 14 h. 30. Elles durent environ trois heures et sont gratuites. La limite d'âge minimum imposée est de seize ans.

Please write or call:  
Ecrire ou téléphoner:

**CERN**  
**Visits Organization / Organisation des visites**  
**1211 GENEVA 23 Switzerland**  
**Tel. 022/767 40 52 or/ou 767 41 02**  
**Telex 419 000 CER**

**LA QUALITÉ QUI COMMUNIQUE**

Vos imprimés reflètent votre image choisissez les hommes  
les machines et les  
moyens de demain

**PRESSES CENTRALES LAUSANNE SA**  
7, rue de Genève  
1002 Lausanne  
Tél. 021/20 59 01  
Téléfax 20 59 50