

in a plasma column of quasi-uniform density and the electric focusing associated with the charge density variations induced either by high power lasers or by high intensity particle beams. Besides acceleration techniques like beat-wave or wake-field accelerators outside the scope of the workshop, applications are foreseen in collecting lenses, final focusing for future linear colliders or heavy ion fusion, wigglers with a short period of beam undulation and self focusing of intense beams in a plasma loaded channel.

Faced with challenges and stimulated by the excellent spirit of the meeting, the participants unanimously agreed to go ahead with a new series of workshops named CAPRI (Common Accelerator and Plasma Research Initiatives) as tribute to the blessed island. An organizing committee composed of B. Autin and H. Riege (CERN), J. Christiansen (Erlangen), A. Dangor (London), U. De Angelis and L. De Menna (Naples), J. L. Bobin (Paris); R. Bingham (Rutherford Appleton Lab.), T. Katsouleas (UCLA) will meet in Paris in November to prepare the next workshop which will take place at Rutherford Appleton Laboratory (UK) in April 1989.

From B. Autin

Double beta decay

Steve Elliott, Alan Hahn and Michael Moe, working at the University of California at Irvine, have seen a new kind of radioactivity – double beta decay – expected for more than half a century but only observed after nearly 40 years of painstaking investigation.

In ordinary single beta decay, a nuclear neutron decays into a proton, releasing an electron and an antineutrino. The resulting nucleus, lighter but containing an extra proton, moves up a rung in the periodic table.

Soon after the formulation by Fermi of the classic theory of beta decay, it was realized that double beta decay could be possible between suitable parent and daughter nuclei two rungs apart in the periodic table. However even if the daughter nucleus were much stabler than the parent, the process would take about 10^{17} years. Here was a challenge for experimentalists.

Excitement mounted in 1948 when one of the first searches reported hints of an effect in the beta decay of tin 124 to tellurium 124, however this was soon attributed to impurities in the source which can easily mask any tiny double beta decay signal.

Experiments then turned to geochemical searches, hoping that ores rich in the parent nucleus would have accumulated observable amounts of daughter nuclei. While this method gave some evidence for double beta decay, it cannot see the decays directly.

In 1974, Moe began looking for the decay of selenium 82 into krypton 82, using 14 grams of the rare selenium isotope, initially with no success. However the development of the time projection chamber provided a new way of tracking the beta decay electrons. After several years patient work to reduce background, the team eventually isolated the tell-tale two electron signature.

With events being seen every few days, the half-life for the decay comes out as about 10^{20} years, in accord with earlier estimates from

geochemical measurements.

With this new kind of radioactivity now in the bag, the search goes on for an even more exotic form of beta decay – the so-called neutrinoless type, first suggested by Furry in 1939, where the two neutrinos swallow each other up and are not emitted. This requires a special kind of neutrino behaviour, with important implications for this still mysterious particle. The search continues.

From one surprise to another

In 1973 physicists were surprised to find that the total proton-proton reaction rate rose in the energy range (20-63 GeV) opened up by the CERN Intersecting Storage Rings (ISR). Previously, it had been widely believed that the reaction rate was approaching some fixed value, about 40 millibarns.

The total reaction rate (cross-section) is proportional to the imaginary part of the forward scattering amplitude, a complex number whose real part can be related to the imaginary part. In 1965, N. N. Khuri and T. Kinoshita had predicted that if the total cross-section becomes infinite at infinite energy, the real part should eventually become positive.

The real part of the scattering amplitude was measured at the ISR by looking at the interference of nuclear and electromagnetic effects and found to be positive. Combined measurements of the cross-section and of ρ , the ratio of the real and imaginary parts, led to rather tight predictions at higher energies. The total proton-proton and proton-antiproton cross-sections