Physics in isolation

Berkeley Conference

With some 1600 participants from 45 countries, the 23rd International Conference on High Energy Physics held in Berkeley, California, from 16–23 July was one of the biggest and best organized particle physics meetings ever. Despite the mammoth attendance, there was only a meagre catch of stimulating new results. An exception was the neutrino sector, still controversial after nearly sixty years. With so many physicists busy these days preparing new detectors for high energy machines, a boom of new results when all the new detectors come online should be only round the corner. More ebullient these days is the particle physics/nuclear physics interface, covered at the recent Lake Louise meeting (this page). A report on the Berkeley meeting will feature in our October issue.

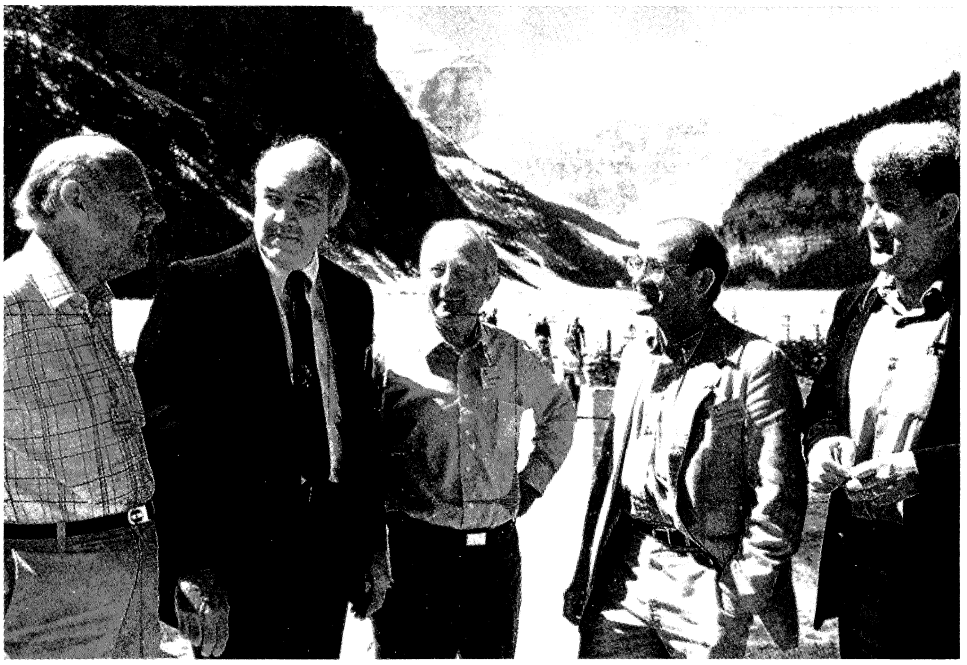
G.F.

In late May, about 330 physicists made their way up to isolated and beautiful Lake Louise high in the Canadian Rockies about 100 miles west of Calgary in a second effort to increase interactions between particle and nuclear physicists. The conference series aims to foster exciting and diverse physics by bringing the different physicists together somewhere which is so isolated that they must interact with each other. The formula worked very well at Steamboat Springs in 1984 (see September 1984 issue, page 283) and the more isolated Lake Louise was a huge success.

Several totally new results were presented, but much of the excitement came from reevaluations of earlier surprising results. In his understated manner Robert Hofstadter concluded, '... we experienced a consolidation and extension of previously known material at this conference.'

The value of the neutrino mass was discussed extensively. New SIN and Los Alamos measurements set upper limits of respectively 18 eV and 25 eV which question the earlier Russian measurement (see June issue, page 15). Suggestions for neutrino oscillations from CERN and from the Bugey reactor were questioned by recent Brookhaven results which appear to exclude most of the Bugey and CERN domain. Hamish Robertson (Los Alamos) concluded: 'There is no non-controversial evidence for non-zero neutrino mass.'

The so-called EMC effect was discussed extensively, especially by E.L. Berger (Argonne) and by R.G. Arnold (SLAC/American University). The earlier results had strongly suggested that quarks in nuclei behave differently than quarks in nucleons. In particular, the quark content of free nucleons and nucleons in nuclei appeared to differ, with the difference depending also on kinematics. The new data show a less marked effect, which is less difficult to understand in terms of conventional nuclear physics.



In the isolation of Lake Louise in the Canadian Rockies, particle and nuclear physicists get together. Left to right Sir Denys Wilkinson (Sussex), Bill Wallenmayer (US Department of Energy), Louis Rosen (Los Alamos), Alan Krisch (Michigan and retiring Chairman of the Organizing Committee) and Erich Vogt (TRIUMF, new Chairman).

Don Perkins of Oxford talks on particle physics away from accelerators.

(Photos Lorne Waldman)

A further talking point was new polarization experiments and the continuing saga of just where perturbative quark field calculations (QCD) are applicable. Thomas Roser (Michigan) reported on the recent successful operation of the Brookhaven polarized proton beam at 22 GeV (see May issue, page 17). This allowed spin experiments at previously unattainable energies by three groups of experimenters. One experiment found that the spin-spin forces in wide angle proton-proton elastic scattering change very rapidly as the polarized beam energy increases. While some theorists had predicted oscillations or decreases, none had predicted a sharp and dramatic decrease. This new spin data added fuel to the lively debate in the lectures by Elliot Leader (Birkbeck College, London), Peter Lepage (Cornell), and Nathan Isgur (Toronto), and by Ed Berger and others in the audience. Opinion was sharply polarized (!), and Elliot Leader declared: 'While many perturbative predictions of polarization effects have not been tested, all those predictions which have been tested disagree with experiment.'

It was clear that much progress must be made before nuclear physics can be understood from quark field theory. The understanding of the nucleon-nucleon force from quark models, discussed by M. Oka (Pennsylvania), is still at a very primitive stage with only the short range repulsion being given by quark models. However, J. Speth (Los Alamos) indicated that even the short range part of the force gives problems since the quark models have trouble reproducing the spin-orbit force needed to fit the data that arises naturally in meson exchange models.

In light nuclei progress is being made both experimentally and theoretically. P. Bosted (American University) reported that measurements of the deuteron magnetic form factor have now been extended. This will put strong constraints on models. The rapid variation of the tensor polarization seen by previous experiments on elastic pion-deuteron scattering now disagrees with three independent measurements by two quite different methods according to G. Smith (TRIUMF); this reduces the need for dibaryons.

For all nuclear systems the need for the relativistic Dirac equation is still being debated (see June 1985 issue, page 183). C. Horowitz (MIT) and J. A. McNeil (Drexel) discussed the so-called Dirac phenomenology which has had much success in proton scattering and has recently resolved discrepancies with the magnetic moments. However, M. Thies (Vrije), pointed out that the successes of the Dirac approach can be reproduced without relativity by the careful treatment of short range effects without introducing the antiparticles.

The evidence for a 'stiff' nuclear equation of state from relativistic heavy ion collisions is growing according to R. Stock (Frankfurt) and J. Harris (Berkeley). This evidence comes from both pion production and information on collective flow. J. S. Greenberg (Yale) and B. Mueller (Frankfurt) discussed the remarkable positron lines seen in heavy ion collisions (see April issue, page 22). While the interpretation is still not certain, the existence of a light particle is not definitely ruled out.

The conference again maintained a uniquely equal balance between particle and nuclear physics. Recently there has been a significant increase in the activity and excitement of particle and nuclear physics in the 1 to 100 GeV range. In the hope that regular meetings contribute to this growth, the organizing committee decided to have a third conference in May 1988. Alan Krisch (Michigan) retired as Chairman and is succeeded by Vice-Chairman Erich Vogt (TRIUMF), while Vernon Hughes (Yale) becomes the new Vice-Chairman. There was much discussion on finding a spot for 1988 which beats Lake Louise for beauty and isolation. This remains a challenge.