

Spin 1990

The idea of the intrinsic angular momentum, or 'spin', of a particle has played an essential part in fundamental physics for more than 60 years, and its continuing importance was underlined at the 9th International Symposium on High Energy Spin Physics, held in September in Bonn.

The opening historical lecture was given by C. D. Jeffries (Berkley) who pioneered the development of polarized targets along with A. Abragam. Back in the 1950s when this work was done spin was expected to be a trivial complication in high energy reactions.

However it is now clear that this is far from true. A. D. Krisch (Michigan) from the experimental side and N. E. Tyurin (Protvino) from the theoretical side discussed the surprising new data in violent proton-proton scattering. In particular the new AGS data on the single spin asymmetry show a clear growth of polarization effects (September/October, page 34) difficult to accommodate in standard perturbative quark-gluon field theory.

Looking for possible explanations, P. Kroll (Wuppertal) introduced a diquark model. The standard picture often fails in connection with spin phenomena, and the strong relation between spin, chirality (handedness) and anomalies and the resulting implications for high energy interactions was described by R. Peccei (Los Angeles).

Polarization data with the highest available proton energies at Fermilab and Protvino (USSR) were presented by A. Yokosawa (Argonne) and S. B. Nurusev (Protvino) and recent measurements of baryon magnetic moments and hyperon polarization by J. Lach (Fermilab) and K. J. Heller (Minnesota). Hyperon polarization is astonishing, ap-

pearing to be due completely to the 'sea' of virtual quarks surrounding the three valence quarks.

V. Hughes (Yale) explained the new muon magnetic moment experiment planned at Brookhaven (April 1989, page 7). The extreme precision of experimental and theoretical determinations of the anomalous magnetic moment of the muon test for possible quark substructure and allow a lower bound measurement of the mass of the Higgs particle responsible for electroweak symmetry breaking.

Another hangup is the so-called 'proton spin crisis', where data from the European Muon Collaboration at CERN (June 1988, page 9) showed that quarks carry almost none of the proton spin. H. Rollnik (Bonn) discussed models presented in a parallel session by B. Ioffe (Moscow) and A. Efremov (Dubna) and others, offering ways out of the crisis, but only new experimental information can resolve the problem. A comprehensive list of experiments planning to probe the spin structure of protons and neutrons was outlined by K. Rith (Heidelberg).

A highlight of the symposium was the important progress towards polarized beams, with reports by A. Blondel (CERN-LEP), D. P. Barber (DESY-HERA), K. Moffeit (Stanford-SLC) and N. Horikawa (Nagoya-TRISTAN). LEP saw about 10% electron polarization at 50 GeV (see November, page 3) while TRISTAN reported an unexpected 40% electron polarization at 29 GeV (see page 11).

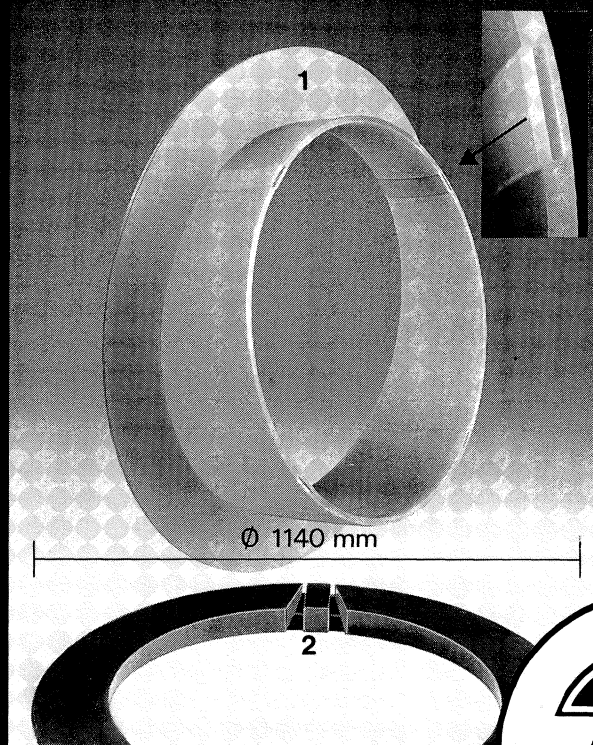
This was followed by discussion of experimental proof of the 'Siberian Snake' concept pioneered in 1974 at Novosibirsk and recently demonstrated at Indiana (January/February, page 20), described at Bonn by T. Roser (Michigan).

C. Y. Prescott (Stanford) summarized the recent spin symposium in Bonn.



For the first time, intermediate energy spin physics with electron machines was comprehensively reported at this symposium. Recent results from Kharkov and Yerevan were discussed by P. Sorokin and H. Hakopian. The physics programme for the new stretcher accelerator ELSA at Bonn was presented by G. Anton (Bonn), W. Heil (Mainz) explained the future plans at MAMI (Mainz), while S. Kowalski (MIT) illustrated the Bates plans and S. Nanda covered the CEBAF (Newport News, Virginia) spin programme.

Using the electron as a probe, the fundamental properties of particles – sometimes embedded in a nuclear medium – will be investigated. Examples are the neutron electric form factor and detailed study of the excited or polarized nucleon-nucleon interaction. This research is closely related to that of the intermediate energy hadron machines, described by M. Locher for PSI (Villigen, Switzerland), by F. Lehar (Saclay) for Saturne, by W. van Oers (Manitoba) for KAON, proposed at TRIUMF, and D. Rapin



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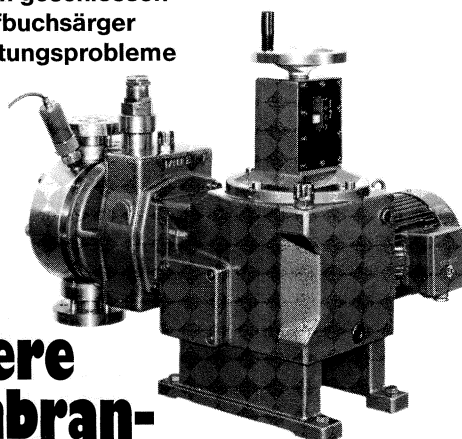
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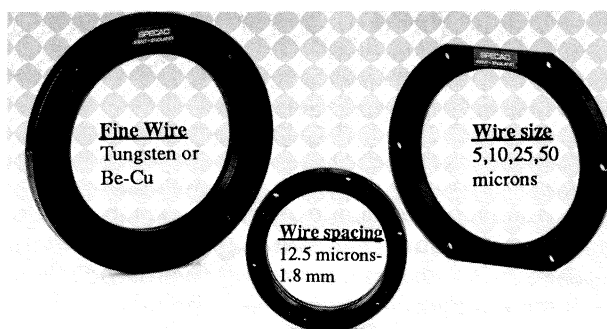
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(Geneva) for the LEAR ring at CERN.

Summarized by C. Y. Prescott (Stanford), the symposium attracted 280 participants and was organized by the Physikalisches Institut der Universitaet Bonn under the leadership of K.-H. Althoff and W. Meyer.

kom Gisela Anton

KEK TRISTAN polarization

Following the observation of high energy polarized (spin-oriented) electrons in CERN's LEP electron-positron collider (November, page 3), comes news of polarized beams in the TRISTAN electron-positron collider at the Japanese KEK Laboratory.

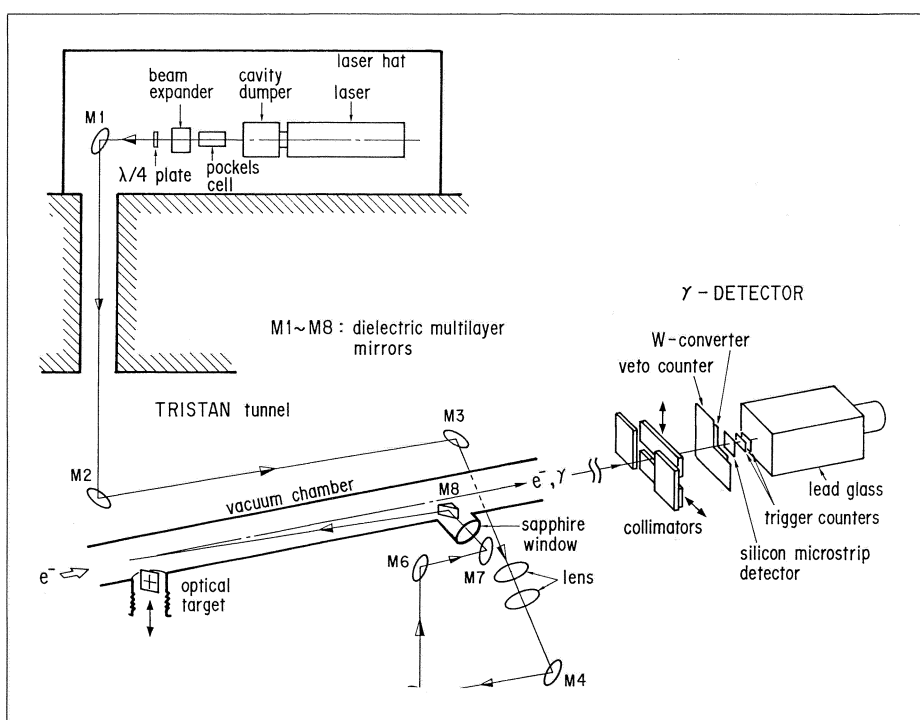
In electron-positron storage rings, the electrons and positrons are transversely polarized (respectively antiparallel and parallel to the guiding magnetic field) through the Sokolov-Ternov synchrotron radiation effect. This radiative spin polarization has been observed in many storage rings, although generally lower than the theoretical limit of 92 per cent, due to depolarization effects in a real system.

For example at the PETRA ring at the German DESY Laboratory,

polarization levels around 80 per cent were achieved in the early 1980s around 16 GeV beam energy by depolarization compensation. However for higher energy rings such as TRISTAN, HERA and LEP, theoretical calculations predicted a pessimistic level of radiative polarization.

To investigate the natural radiative polarization at TRISTAN, a Compton polarimeter was installed during the 1989 autumn shutdown, and during the May-July run this year polarization of about 40 per cent was observed at 29 GeV beam energy.

The present polarimeter detects circularly polarized laser photons which are Compton scattered by beam electrons, and allows simultaneous measurement of both transverse and longitudinal components. Vertically polarized electrons give an asymmetry in the vertical distribution of backscattered photons, while an asymmetry in pho-



A schematic of the apparatus used for measuring beam spin orientation (polarization) at the TRISTAN electron-positron ring at the Japanese KEK Laboratory.