Dedication of PETRA at DESY

On 26 April, the electron-positron storage ring PETRA was dedicated at DESY by the President of the Federal Republic of Germany, Walter Scheel, in the presence of the Minister for Science and Technology, Volker Hauff, and senior dignitaries of the State and Science.

PETRA is designed to achieve a peak energy of 19 GeV in each beam, when all 64 RF cavities are installed at the end of this year. At present, with 32 cavities in place, it is operating at 13.7 GeV per beam with a luminosity of 5×10^{29} cm^{-2}s^{-1}.

EPS was represented at the celebrations by its President, Antonino Zichichi who handed to Herwig Schopper, Director of DESY, an EPS Special Scholarship to mark the occasion. The scholarship, which is applicable to any one of the international schools of the "Ettore Majorana" Centre for Scientific Culture, will be awarded to a young physicist at DESY.

Zichichi's Address

After greeting the company in the name of the European physics community, Zichichi went on to express "our great satisfaction at seeing accomplished this important new step (PETRA) at the frontiers of science.

Why is this important ? Because today we live in a peculiar world. If we wish to summarize in few words what mankind has done on this planet since the beginning of his appearance, here is the result: He invented language about 300,000 years ago, and it is thanks to language that we can communicate with each other so efficiently and so synthetically. Think how difficult it would be to express concepts and thoughts via gestures. But language is not enough. Three thousand years ago Man discovered logic. Logic is a set of rules which, once accepted, bind you not to violate them and force you not to contradict yourself. Mathematics is the most rigorous form of logic. But the study of logic does not bind you to Nature. The logic of Nature is science — modern science — Galilean science discovered 350 years ago.

Language, logic and science are the greatest achievements of human intellect. However, the culture of our time is dominated by language. Neither logic nor science are recognized in their role of shaping the future of mankind.

We need more science, more knowledge. Why ? Because if you ask yourself what is the very distinctive feature of mankind, you find that this is science. The science of animal behaviour, ethology, tells us that mankind is similar to other forms of living matter, much more than would have been thought. Man does a lot of things: eats, sleeps, speaks, works, makes love — also war, etc. but in all these acts of daily life he is very similar to many other forms of living matter. Yet, one of his activities is very distinctive, and this is science i.e. the search for, the discovery of, and the understanding of the basic laws of Nature.

If each form of living matter develops itself according to its most distinctive feature, no doubt, everybody one day will be a scientist. Not in the sense that everybody will make fundamental discoveries, but rather that every human being will understand the intrinsic value of studying the fundamental laws of the world in which we live.

Yet in the 3000 years from Archimedes to the present day, the total amount of money that has been invested in pure scientific research is equivalent to 10 or 14 days of the USA gross national product (this figure is at present being investigated by a group of MIT experts).

Just for a moment let us contemplate the fact that every object — the air, the water, a flavour, the food we have eaten today — everything is made of three and only three things: the proton, the neutron, and the electron. Is this not fascinating ? Think now of the proton. Its longevity is measured to be at least 10^{20} times greater than that of the Universe. This means that the longest interval of time conceivable by mankind, i.e. the life of the Universe, is like the time of a single heart-beat for the proton. We are made of particles that are incredibly stable. These are just two examples of the knowledge provided by science to mankind. What remains is even more impressive, despite the very small effort mentioned above.

Subnuclear physics is in the forefront of modern science. The PETRA machine is the newest jewel, and on behalf of the forty thousand physicists of all the countries of Europe — east and west, north and south from the Soviet Union to Portugal, from Finland to Greece — I would like to express our gratitude for all the efforts that have been made here to accomplish this great venture."

Solar Physics Section Workshop

An abridged version of the original summary

In October 1977, the Board of the Solar Physics Section of the EPS invited me to organize in Catania an EPS Workshop on Solar Rotation. This was held in September 1978 at the Catania Astrophysical Observatory, and was attended by 22 participants, observers and theoreticians actively working in the field of solar rotation.

The aim of the Workshop was to obtain a more profound understanding of observations showing that the measurement of different spectral characteristics with origins at different levels in the Sun's outer layers: sunspots photospheric lines, Hα and other chromospheric lines, K-corona features etc., that we group under the generic name of tracers, results in different rotation laws, and we find apparent angular velocities that vary with time. Spectroscopic observations show that photospheric plasma rotates more slowly than the corresponding tracers, while at the chromospheric and coronal levels, the situation is reversed. These measurements show also short and long period variations of angular velocity. Some tracers show a double rotational behaviour, rigid and differential depending on their stage of evolution and on the solar activity cycle. The equatorial velocity does not seem correlated with the strength of differential rotation. The spread of data is larger for spectroscopic measurements which however are supposed to be more accurate than the corresponding tracer measurements.

Why does the plasma show a very different behaviour according to the tracers used to measure its velocity ? Does the large spread of data reflect the physical behaviour of the phenomena, or are the observational techniques affected by random and systematic errors ? Do the tracers really describe the motion of the fluid in which they are immersed ?

It emerged from the Workshop that the long standing discrepancy between tracer and spectroscopic measurements could be considerably reduced by taking into account the

effects of the scattered light on Doppler shift measurements.

Theoreticians have been trying to explain the generation and maintenance of the observed equatorial accelerations by a mechanism which transports angular momentum towards the equator against the viscous dissipation. Now it seems well established that this mechanism is located in the convection zone and it is produced by the interaction of convection with rotation. Boussinesq models of convection in a rotating spherical shell are unsatisfactory, as they can hardly be applied to the Sun, due to the high stratified character of its convection zone. Inclusion of the compressibility appears to be essential for understanding, even in a qualitative way, the solar rotation mechanism.

The problem of the generation of the magnetic cycle cannot be disconnected from the differential rotation problem. The mean magnetic field propagates in fact along the surfaces of isorotation, which therefore must be shaped by differential rotation in such a way that they allow for a correct field migration in order to display the observed Butterfly diagram.

Much has to be done in this field such as the inclusion of non-linear interactions in compressible models of solar rotation and also on dynamo models to take into account the back reaction of the magnetic field on the velocity field. But we probably are on the threshold of a much deeper understanding of the solar convection zone and solar activity, and by extrapolation we shall be able to add significantly to our knowledge of stellar structure and evolution.

L. Paterno

European Great Projects Errata and Addenda

LEP Technology

In last month's account of the Great European Projects, when writing of LEP, we confused the arguments relating to the choice of the ring magnets with those of the RF cavities. In a large diameter machine such as this e^+e^- collider — 10 km for a maximum energy of 130 GeV (cf. the ISR proton-proton collider at CERN which for an energy of 31 + 31 GeV has a diameter of 0.3 km) the magnetic fields in the ring magnets are so modest there is no advantage to be gained in using superconducting techniques. However, the large powers needed in the RF cavities make superconducting techniques very interesting, provided the outstanding problems can be solved. LEP has, therefore, been designed with a magnet ring that will cater for the highest energies and with an RF system that can be stepped up in stages. To begin with, conventional RF cavities would be used, but later it is hoped that it would prove possible to go over to superconducting cavities.

It should also be noted that the design team has throughout been working on a single ring concept, only in the original proposal 32 circulating bunches were envisaged, leading to 64 intersection points, at only eight of which the beams were made to collide. In the later design there are, as previously explained, four bunches circulating in each direction which cross at eight intersections, all of which are used for experiments.

Cost of the second proposal would be around 1000 M Sw.Fr. — unfortunately not 100 M Sw.Fr. as was printed.

Hadron Colliders

It will have been evident that we also had printing problems with our antiproton sign and for clarity we repeat the CERN and NAL projects for hadron colliders:

NAL Tevatron development:

proton-proton	1000	+	250 GeV
proton-antiproton	250	+	250 GeV
or with cooling	1000	+	1000 GeV

CERN modified SPS:

proton-antiproton: 540 GeV centre of mass.

European Synchrotron Radiation Facility

The Chairman of the Instruments and Beamlines sub-group for the study of the facility is Dr. B. Buras and not Furas as cited.

IRAM

Since the Rome Seminar the agreement between the CNRS and the Max-Planck-Gesellschaft covering the setting up of the Institute for Radio Astronomy in the Millimetre Range has been signed. Provisional premises were to be available in Grenoble from 1 May.

1979

Hewlett-Packard Europhysics Prize

The 1979 Hewlett-Packard Europhysics Prize has been awarded to a group of five physicists from several European countries for their contributions to our understanding of the interaction between surface acoustic waves and electrons and the practical application of the effects to a new range of devices of particular importance in information handling.

The winners of the award who will share equally the 20 000 Sw.Fr. prize are:

Eric A. Ash, University College, London

Jeffrey H. Collins, University of Edinburgh

Yuri V. Gulaev, Institute of Radio Engineering, Moscow

Kjell A. Ingebrigtsen, Norwegian Institute of Technology, Trondheim

Edward G. S. Paige, Department of Engineering Science, Oxford University

Electron-phonon coupling is one of the fundamental interactions encountered in solids, governing many dissipative phenomena as well as superconductivity. The prize is awarded in particular for the work relating to electron-phonon coupling in piezo-semiconductors and layer structures, and methods for slowing down the acoustic waves so that they are a better match to the drifting electrons.

Previous winners of the Hewlett-Packard Europhysics Prize were:

1978 Zh. I. Alferov, A. F. Ioffe Physico-Technical Institute, Leningrad;
physics of heterojunctions.

1977 W. E. Spear, University of Dundee;
amorphous silicon devices.

1976 W. Helfrich, Freie Universität, Berlin;
physics of liquid crystals.

1975 V. S. Bagev, L. V. Keldysh and J. E. Pokrovsky, Lebedev Physical Institute, Moscow and M. Voos, Ecole Normale Supérieure, Paris;
condensation of excitons.