

TRENDS IN PHYSICS

With so much of physics coming under review, only a brief sketch of some of the general topics of the Conference can be given; a more complete appraisal must await the publication of the Proceedings. One immediate observation from the programme can, however, be made, namely the growing interaction of so many areas of physics. Such interrelations are the main-spring of the EPS General Conferences and the interest of participants in this aspect could be assessed by the large attendance at the Plenary Sessions right until the last, and the mixing of participants in the different parallel Symposia.

What is Physics?

So broad are the activities of physicists these days, spreading out into chemistry, biology, agriculture, engineering..., one can begin to wonder what physics is. G. Marx (Budapest, Hungary) described it not in the manner of former definitions which attempted to distinguish it from other sciences, but simply as "what physicists do in the night". This is sufficient, because physicists recognize and understand each other. Physics brings objectivity and precision to fields that have had to rely on empiricism. It has not only to explain, but also predict and fit new observations into a coherent overall picture. Physics is also concerned with reality. There is a tendency for physical laws, as they become more universal to become also more abstract, but establishing the bridge between fact and universal law is more important than the law itself. Marx' image of physics was drawn essentially as this bridge between natural philosophy and everyday facts.

Yet what are physicists' preoccupations in the teaching institutions much of the time: restricted budgets, fewer jobs, fewer top-level students, decreasing interest in the schools. This last is serious because encouraging the young is the key to constant renewal. We tend to give the impression that physics is "a compendium of facts invented by clever men" and that nothing is left for the new generation. We tend also to leave classical physics to the engineers, nuclear physics to industrial technologists, biophysics to the medical schools and the structure of matter to chemists. Other sciences do not do this: mathematics

has kept statistics and computers, chemists chemical engineering. One reason is that physicists are best in unknown territory. They have methods of discovery and analysis and they are essentially pioneer-minded, working at the extreme limits of energy, scale, time and temperature.

Society has always had a science on duty — shaping our world picture, innovating technology and attracting the brightest young brains. Physics has a tradition of being the team leader and should be geared to carrying on this tradition in the years to come.

Public Image of Physics

The image of physics in the public's mind was examined in a special Seminar which also echoed the importance of teaching in the schools, as the impres-

sions gained at school level were the dominating influence later in life. Less than 1% of those who are taught some physics in school became physicists, so the need to give a proper introduction to the subject was not a trivial matter. Yet there was a marked reluctance to move away from the cataloguing of cold, provable facts to presenting physics as it is — advanced by people who have emotions, who make mistakes and are engaged in a subject that is exciting and full of surprises. P.J. Kennedy (Edinburgh, Scotland) suggested that physicists should think in advertising terms, but in contrast to the makers of soap powders, should take as their slogan "physics does *not* wash whitest" (i.e. does not try to hide the reality).

G. Born (Duisberg, FRG) took up this theme and stressed the need to use all

INVITATION TO TENDER for the PUBLICATION OF EUROPHYSICS LETTERS

Following discussions with the national physical societies of Europe that are members of the European Physical Society, in particular those of France, Italy and the United Kingdom, and in full consultation with its scientific divisions, the European Physical Society is planning to publish from 1 January 1986 a general physics letters journal incorporating *Journal de Physique Lettres* and *Il Nuovo Cimento Lettere*.

A publishing contract will be awarded on the basis of the responses received in reply to this international call for tenders. Publishing houses established in Europe with a broad experience of publishing scientific periodicals of international repute are eligible to tender. The specification on which the tenders will be judged is set out below.

Companies wishing to tender should first contact:

G. THOMAS, Executive Secretary
European Physical Society, PO Box 69, CH-1213 Petit-Lancy 2
Telephone: Geneva (22) 93 11 30

Tender Specification

The tender should cover the following publishing operations:

- Item 1: Technical editing, proof reading, page lay-out, contents page; Typesetting (text and formulae), first proof, corrections; Camera work on figures and photographs; Page make-up, second proof, corrections.
- Item 2: Purchase of paper.
- Item 3: Platemaking, printing (including covers) in black only, binding.
- Item 4: Addressing, postage and dispatch.
- Item 5: Subscription servicing.
- Item 6: Marketing for library subscriptions.

Journal Specification

- Format: B5
- Characters per page: 3750; 25% mathematics and tables; 10% figures
- Paper: 80 g/m² inside
130 g/m² tinted, covers
- Volume: 1536 pages (24 issues) per year maximum
- Circulation: estimated subscription base of 1000 copies

Presentation of Tender

Prices should be quoted in the currency of the country in which the company is registered or in Swiss Francs and should be itemised as follows:

- Item 1. Two prices (a) for 960; (b) for 1536 pages per year.
- Item 2. Price per 1000 copies of 64 pages.
- Item 3. Price for 1000 copies \pm 200 per issue of 64 pages.
- Item 4. Price per 1000 copies assuming 15% in country of dispatch, 20% N. America.
- Item 5. Price for 1000 subscribers or as a percentage of net receipts.
- Item 6. Commission.

Schedules

Quotations should be accompanied by a statement of the time to be expected from the receipt of manuscripts accepted for publication to their appearance in print.

the modern techniques of mass communication — newspapers, periodicals, radio and TV, popular books. Exhibitions and museums attracted a wide spectrum of the public and the efforts, notably in France, of associating with a big conference a public walk-in, talk-in, had met with a great deal of success. Few people, however, wanted the detail — different audiences required different levels of exactness and were capable of different levels of understanding. There was a general wish to see physics in a social context but as one speaker noted, this should not be interpreted in the narrow terms of practical (i.e. saleable) applications. The areas of physics that received the “best press” were astrophysics and high energy physics, yet these were the big spenders with little immediate impact on the economy. The public understood the cultural value of gaining new knowledge for its own sake and, if physics seemed fun, so much the better.

Bring on the Girls

This may be the key also to attracting more women to take up physics as a career. Much effort has been devoted in some countries — in Sweden for example, as B. Jönsson (Lund) explained — to attracting girl students to take up physics although, it had to be admitted the success had been meagre. The reason would appear to lie in the essentially male oriented nature of physics courses as they are presently conceived. These should be restructured but a shift in public (notably parent) attitudes is also needed.

Sensors

Cutting across all experimental physics was the Symposium on Sensor Research and Technology, where participants were treated to a survey of the very wide range of devices that solid state research and silicon technology especially had made possible. Nevertheless as W. Henning (Munich, FRG) emphasized, the spread of microcomputer techniques, even if rapid over the past ten years, was hampered by a lack of low-cost, reliable and compatible sensors. This statement contrasted with the very large range of devices that were reviewed by various speakers but as, for example, H.P. Baltas (Edmonton, Canada) discussed in his talk on magnetic sensors, there could be a large gap between the potential capabilities of a sensor used under controlled laboratory conditions and a device that had to stand up to the rigours (not least the variable temperature) of industrial operation.

Agriculture

Even more down to earth and eminently fitting for a Conference held in an agricultural college was the Seminar on Physics and Agriculture.

To the uninitiated, this was an eye-opener, showing how far farming had moved from the *ad hoc* methods of the past. In his introductory talk, R. Reznicek (Prague, Czechoslovakia) surveyed the astonishing range of activities of physicists in the agricultural domain and it became evident that physicists were finding their place not only in making physical measurements as such, but also in integrating the contributions from physics, chemistry and biology into an economically meaningful system of management.

Despite food production having been one of the oldest pursuits of the human race, surprising little was known until recently of the elementary characteristics of basic materials. Yet if one is to design efficient and energy effective mechanical methods, it was necessary to know the shape, porosity and roughness of the materials handled. Fluid flow characteristics came into the design of feed transport systems; rheological properties into grinding and crushing; optical properties in sorting and selection; friction coefficients into many operations such as grain harvesting; compressibility and elasticity properties into such different applications as silage storage and machine milking; impact characteristics into fruit picking; sedimentation processes into manure treatment; aerodynamics into potato harvesting; thermal properties and temperature control into storage and germination maximisation. The list continues: acoustics for checking fruit ripeness, the resonant fertilisation of tomatoes, egg cleaning, moisture release from grain, *in vivo* fatty layer assessment... and so it goes on.

There is no lack of academic study in the domain, but the variables are not always those that are familiar to physicists. J. Hellebrand (Berlin, DDR) discussed the interpretation of stress relaxation in plant products based on thermally activated plastic flow, leading to the identification of two determining parameters which correlated to quality. Ultrasound velocity is a function (in potatoes) of both the biostate during storage and the variety. NMR studies on grain have led to the identification of different relaxation times contributed by the solid state, bound water and free water, and extending the measurement to the use of pulsed NMR one finds a correlation between variety, and the ratio of

the initial to the final asymptotic peaks.

If all this seemed a bit far from the practising farmer, S.W.R. Cox (Silsoe, England) brought discussions firmly into the cowshed with some practical examples of farm installations, showing the progressive incursion of cybernetics into farming to give optimum output for minimum input. The traditional cow-bell is replaced by an electronic transponder which allows automatic identification on entering the yard. This is tied to a “walk-through” weigher for daily health control, to automatic milk yield assessment and consequent concentrated food dispensation. Microelectronics and microprocessors have made such systems possible, and electronic measuring devices generally are taking much of the guess-work out of harvesting. A recently developed hand-held moisture meter, for example, is based on IR reflection spectroscopy. Scan the crop and the meter gives an instant on-the-spot average, with built-in correction for grain type.

Human Catastrophe

But perhaps the most globally relevant Symposium was on catastrophes in the past and what could be in the not-so-distant future. J.C. Duplessy (Gif-sur-Yvette, France) reviewed the changing pattern of climate over the past million years, when the continental drift decoupled the Antarctic from the northern hemisphere. The ratio of $^{18}\text{O}/^{16}\text{O}$ in the shells of upper layer marine animals laid down as sediments, calibrated against the ratio for deep level animals (where a constant temperature can be assumed) gives a measure of the average upper water temperature. During the last ice-age, 18000 years ago, when the ice shield stretched down into France and included a major dome in the middle of N. America and two domes in N. Europe, the temperature was a mere 1.7°C lower than today. This figure is also corroborated by the relative abundance of different animal species. A plausible explanation is to be found in astronomical variations: a smaller tilt of the Earth and the minimum Sun-Earth distance occurring in winter. This modifies the weather pattern and consequently the amount of CO_2 in the atmosphere which in turn alters the overall energy balance. From past experience we should have little to worry about from this cause, even so, as the next ice-age would then lie some 200000 years in the future.

However, over the past 100 years, a new factor has entered into consideration — the change in the green-house effect caused by deforestation and the

burning of fossil fuels which have both increased the CO₂ concentration in the atmosphere. K. Heinloth (Bonn, FRG) left no room for complacency. Evidence for a rise in average temperature of 0.3° C since 1880, corresponding to a rise in atmospheric CO₂ concentration from 270 to 340 ppm correlates with the archaeological evidence of temperature swings provoked by naturally stimulated changes in the energy balance.

Catastrophe can be seen at two levels. In one, it can be imagined that a swing in temperature of just a few more degrees, either up or down at a time of extreme temperature in the Earth's recent history (1 Ma) could have given rise to a positive feed-back resulting in the complete extinction of life, either because the seas froze solid or they evaporated completely. The other is much less speculative and concerns the huge social impact of any significant change in average temperature. Heinloth concluded, it would be prudent, to say the least, to take steps to limit the concentration to the highest level known during the historic warmest periods when it was around 450-500 ppm. Yet according to even the most optimistic scenario for energy conversion from fossil fuels, with a reduction of energy consumption in the industrialised countries and a minimum increase in consumption in the developing countries, population expansion alone will see the CO₂ concentration in the next 50-100 years rising from the present 340 ppm to 450 ppm. When the effect of other IR absorbing gases is added, the equivalent figure is around 650 ppm.

Natural compensating processes of exchange tend to be on a longer time scale so this must lead to a major climatic change in Europe and elsewhere which will be extremely difficult socially to absorb so quickly. He saw it as crucial to stop deforestation, reduce fossil fuel consumption to 50% of the present level, cut IR gas emission to 50%, exploit the "renewable" energy resources to the maximum and exploit the potential of nuclear power as quickly as is socially possible.

The Cosmic View

After this disturbing picture of our imminent problems, it was a relief to return to the broader contemplation of the Universe, the Conference concluding with Ya. B. Zeldovich's (Moscow, USSR) grand review of its history from the big-bang. If to ice-age physicists recent history begins one million years ago, the cosmologists go one better — the "new history" begins about one second from the dawn of time. Not all of us were able

to follow Zeldovich's speculation that perhaps the Universe began as a mixture of fields out of which the scalar field could survive because of its negative pressure which could imply that the Universe has a total mass that is zero and it really is closed — geometrically. However, everyone could understand the echo of Marx in his support for the principle of daring to be inventive, exemplified in the astrophysicists' motto: "often in error, never in doubt".

Acknowledgements

No glimpse of the 6th General Conference would be complete without recording our appreciation of the work of the International Programme Committee chaired by L. Van Hove and also the organizers of the parallel Symposia and congratulating the Local Organizing Committee led by J. Kaczer. Not only was the campus (just outside Prague) a charming and effective setting, the on-site accommodation comfortable and the arrangements for feeding efficient, but there was a galaxy of staff anxious to help and make visitors welcome. The reception and Conference party were gay affairs and the "accompanying persons" expressed delight in the organisation of the tours, and for their intrinsic in-

terest and the competence of the guides. To cap it all, the weather was splendid. Those who did not go to Prague missed an invigorating scientific and social occasion. They should plan now for Helsinki — end of August 1987.

UNIVERSITY OF BRISTOL DEPARTMENT OF PHYSICS

Applications are invited for a two-year SERC funded research assistantship to work on concentration fluctuations in random metallic alloys.

The salary scale is the usual SERC RA 1A scale.

It is hoped that the successful applicant will be able to take up the position soon after 1 October 1984.

Applications to be sent to:

Dr. B.L. Gyorffy,
HH Wills Physics Laboratory,
Royal Fort, Tyndall Avenue,
Bristol BS8 1TL, England.

NORDITA COPENHAGEN

ASSISTANT PROFESSOR IN THEORETICAL ASTROPHYSICS

NORDITA, the Nordic theoretical physics institute located at the Niels Bohr Institute of Copenhagen University, has an opening starting September 1985 for a second assistant professor in theoretical astrophysics. The initial appointment will be for three years, with the possibility of renewal up to a total of six years. The annual salary will be in the range of 190 000 - 270 000 Danish Kroner depending on experience. The successful applicant is expected to guide fellows at roughly the post-doctoral level and to interact with colleagues at NORDITA and elsewhere in the Nordic countries. There are good opportunities to participate in observational collaborations, through ESO and ESA, as well as common Nordic projects such as from 1988 the 2.5 m optical telescope, and the Swedish/ESO submillimeter telescope. This position provides excellent opportunities to pursue original research, to travel to other institutes and to meetings, and to invite guest scientists. There is no restriction on the applicant's field of research, though preference will be given to those areas where physics and astrophysics are most closely coupled. Recent research areas at NORDITA include neutron stars, supernovae, extragalactic radio sources, radiation and plasma processes, cosmology, galaxy formation and solar astrophysics.

Those interested in the appointment should send their curriculum vitae, a list of publications and the names of three referees before 15 December 1984 to:

the Director, Nordita,
Blegdamsvej 17, DK-2100 Copenhagen Ø, Denmark.

There is no restriction on the nationality of the applicant. Those wishing to recommend suitable candidates are urged to contact the Director.