on them by the referees. Since its creation, in 1969, the CC has examined more than 200 applications, i.e. 35 applications have been discussed during the last year which include 8 conferences organized by Divisions, 3 Europhysics Study Conferences and 7 Summer schools.

The CC has a more direct action in the case of the EPS General Conferences for which it helps to set up the general framework and the International Programme Committee.

A feed-back is necessary, so each conference organizer has been asked to return, once his conference is over, an appreciation on his meeting in a feed-back questionnaire which also covers the financial aspects. The representatives of the Divisions are regularly reviewing the conference activity in Europe in their own fields.

Some of the features described are not yet as satisfactory as they should be. Too often, applications for conferences are sent at a very late stage and the possible actions are then limited; it is important that the CC be informed, as early as possible, of an intended conference, in particular to avoid possible overlaps. We have also the feeling that there is not yet a correct balance between the applications received from East and West. The contacts with the representatives of the eastern countries should be improved.

Recently, the CC reviewed all Europhysics Study Conferences held since 1969 ; we came to the conclusion that less than half of them actually deserved the denomination of Europhysics Study Conference. The others were rather classical topical conferences. Our CC will be more strict in the future in this matter.

Summer schools are not yet treated in a satisfactory way ; the conference aspects are well scrutinized but there is not yet an evaluation of their pedagogic value. This should be done in the future with the help of the new Advisory Committee on Education.

The CC has recently helped in establishing a new EPS publication containing the abstracts of Europhysics Conferences which will thus be available to all libraries.

As explained before, we are not yet in a position to subsidize conferences. However, EPS has now established a conference fund which might be used somewhat like a solidarity fund. This fund is built-up with a capitation fee per participant paid in by all Europhysics Conferences since September 1974. This Fund will be used in particular to help young physicists to participate in European Conferences. Twenty grants have already been allocated by the Executive Committee, on recommendation of the CC, to young physicists from different European countries to attend the EPS General Conference in Bucharest.

We hope that by its conference activity the European Physical Society is helping to support physics and physicists.

P. Radvanyi, Orsay
(Chairman of the EPS Conference Committee).

Highlights on Laser Fusion

Israeli Scientific Research Conference, Arad, 29 December 1974 - 3 January 1975
8th European Conference on Laser Interaction with Matter, Rynia, Poland, 19-23 May 1975

Besides the magnetic confinement of high temperature low density plasmas (the "Tokomak" device is the most promising) an alternative approach of the nuclear fusion problem deals with short lived super high density systems. The thermonuclear fuel, compressed to densities of up to 10^4 times the solid state, explodes. A few megajoules of fusion energy might hopefully be released in each such burst.

Following the pioneering work of Kastler, Basov and Krokin, and Dawson some ten years ago, it was discovered by J. Nuckolls and L. Wood of Livermore, K. Brueckner of KMS Fusion and the University of California at San Diego, and reportedly at Harwell (UK), that the interaction of laser radiation with microspheres of thermonuclear material may lead to superhigh densities through a nearly isentropic compression. Then the energy investment becomes comparable with foreseable laser sources. Moreover, the yield of the subsequent explosion is kept to a level which causes no harm to the immediate environment.

The physics and technology involved are basically different from those of the Tokomak and scientists in the field have a quite different background. This fusion scheme has raised a growing interest for the last few years and at least in the United States and the Soviet Union the relevant research receives a large support.

It was the purpose of two recent conferences, of interest to the European scientific community, to review the subject without overlooking the advent of a new competitor: relativistic electron beams. The first of these conferences was held at Arad (Israel) near the Dead Sea from December 29, 1974 to January 3, 1975 and was part of the programme of Israeli scientific research conferences.

The second one took place from May 19 to May 23 1975 in Rynia near Warsaw (Poland) and was the eighth European Conference on laser interaction with matter. Both conferences were more or less of the Gordon type, gathering a restricted number of scientists, scheduling ample discussion time and providing a friendly atmosphere.

Putting together the facts and knowledge presented at these two meetings gives a timely account of laser and electron beam fusion.

The emphasis has shifted from theoretical analysis backed by computer simulations to experiments either actually running or being projected on a larger scale.

However, theoreticians still have more to tell. Indeed the principle of nearly isentropic compression of spherical pellets up to more than a thousand fold with respect to solid state now looks firmly established. Large and costly research programmes are based on this theoretical idea. Nevertheless some points remain unclear : the stability of the implosion process under the action of a laser or a relativistic electron beam, which might not provide uniform enough illumination, should not limit the compression. Furthermore, since very high fluxes are required (10^{14}-10^{18} W/cm^2), the coupling between the beam (electron or laser) and the target raises a number of still unsolved problems. When such an amount of power is fed into small spaces (target diameters are typically below 1 mm and a thin superficial layer is expected to absorb the incoming energy), the matter has a tendency to resist ; either by developing instabilities in which the energy is wasted as kinetic energy of unwantedly accelerated particles or by simply rejecting it : lowering of absorption coefficients, reflective instabilities. Extensive work is being carried out in all major labs involved, on the investigation of those processes. New effects are predicted almost every month by the theorist, but there are still no convincing experimental checks.

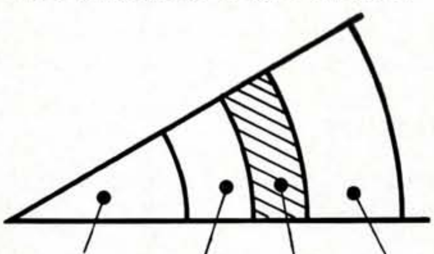
Experiments on the irradiation of solid pellets began in 1971 with the nine Nd glass laser beam set-up built at the Lebedev Institute in Moscow. Elsewhere the number varies between two (KMS Fusion, Lawrence Livermore Laboratory) and four (University of Rochester, Limeil Nuclear Research Center), the maximum flexibility being reached at Los Alamos Scientific Laboratory : irradiation by one, two or four beams of specifically designed targets. The energy is at most 1 KJ. Projects are being developed in the 10 KJ range either with neodymium glass : Livermore, 20 cascades in parallel with 20 cm diameter disc amplifiers ; Lebedev, 216 cascades in parallel with 45 mm diameter rods. The focusing system in the latter case uses elliptic mirrors in tetrahedron geometry. An alternative approach is considered at Los Alamos : a 10 KJ molecular CO_2 eight beam system.

The aim of such big devices, which are to be completed within two years, is the so called scientific breakeven in which the energy released by fusion reactions equals the impinging beam energy. To do so, the target should have an initial mass not greater than 1μg per impinging KJ of light.

Promising new lasers are appearing such as the iodine laser which in Garching has reached the level of 300 J in less than 1 nsec and is now free from parasitic oscillations. Also of interest is the chemical electronbeam triggered HF laser (Los Alamos and Sandia). Energy output is large 2.5 KJ at 2.7μm, but pulses are too long.

Target design has been one of the main concerns for the last few years. The purpose is two-fold. First setting up significant experiments with existing (low energy) lasers, hence the glass microballoons filled with high pressure DT. Such targets are used at KMS, Los Alamos and Livermore; the main diagnostic are X-ray pinhole pictures and the neutron yield reaches 10^7 per shot. Very likely high compressions ($>$ 200) were achieved but the final density is still of the order of magnitude of solid state.

The significance of the neutron emission is questionable. The second point, related to advanced target design, deals with the above mentioned projects. The aim is to maximise the fraction of the incident energy actually transferred to the thermonuclear fuel. The most popular concept involves three components as shown below :



An improvement proposed by people from the Lebedev Institute in Moscow is a thin layer of high Z material inserted inside the thermonuclear fuel to stop any unwanted suprathermal electrons created in the corona.

The present experiments have a specific feature : since the target is very small, diagnostics are exceedingly difficult and the information definitely incomplete. So, one tries to compare results from both sources : the experiment proper and numerical computations. The latter are very sensitive to the choice of physical processes and constants. Studies at KMS and the University of Rochester show no deviation from classical processes when targets are irradiated by laser fluxes up to 10^{15} W/cm^2.

However, the occurrence of fast (suprathermal) ions is still a puzzle. First because not all laboratories claim consistent experimental evidence : at Rochester they see none, at Livermore and KMS quite few and only occasionally, at Los Alamos, on the contrary, the numbers observed justify specific studies specially in laser interaction with thin (350 Å) slab targets.

An important effort is made on X-Ray detection by pinhole cameras and spectroscopy, the latter point being specially developed at the Naval Research Lab. (USA). The pinhole technique is a way of looking directly at the compression and the unstable behaviour, if any, in the implosion of void shells under symmetric or asymmetric illumination (Los Alamos).

The experimentalists are also concerned by the laser plasma interaction proper by studying the reflectivity and taking pictures of the relevant zones in harmonic ($2\omega_L$ or $3/2\omega_L$) emission (Rochester and Limeil).

Some experiments with electron beams are (apart from the energy involved) the exact counterpart of laser irradiation. The main problem which seems to be partly solved is the focusing of the beam to get energy densities onto the target of the same order of magnitude as those obtained with lasers. A plasma on the axis does the job by neutralizing the space charge. One and two beam irradiation of metal targets have been performed (Sandia Laboratories USA) and indirect diagnostics are consistent with successful implosions. The main effort to be done on the generator deals with pulse shortening. Also diagnostics look quite difficult. However, electrons impinging onto a (necessary high Z) target emit X-Ray bremsstrahlung which might give information about the interaction process and the stability.

To sum up the comparison between laser and electron beams, it can be said that the electron generators have the energy and efficiencies, whereas the laser has the flexibility and a firmer theoretical background. However, a combination of the two has not been considered so far while combining the effects of lasers and high explosives is under investigation at the Polish Academy of Sciences.

The subject is progressing very rapidly. Taming thermonuclear energy is one of the most fascinating endeavours. Even if it fails, good physics will be made in unexplored domains.

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