morphology are also to be found on the Earth's surface in New Mexico.) Nearer the poles of Io, the terrain is more irregular and several mountain ranges are visible with peaks several kilometres high.

Shortly after the two fly-bys of Io, geochemists set out to describe the composition of the satellite's crust. Any interpretation of the eruption processes has to be compatible with the temperatures registered by the probes, which indicated that the surface was in the main very cold (−146° C). On the other hand, zones of higher temperature have been located, notably in the vicinity of the volcano Loki where temperatures in excess of 17° C have been measured. This is nevertheless much below the melting point of sulphur (112° C) and the theory has been advanced that a solid layer of sulphur and SO_2 is covering an ocean of liquid sulphur (Fig. 6). In the model of B. Smith (University of Arizona), the plumes would be produced by volcanic eruptions of a phreatic type, such as is observed on Earth.

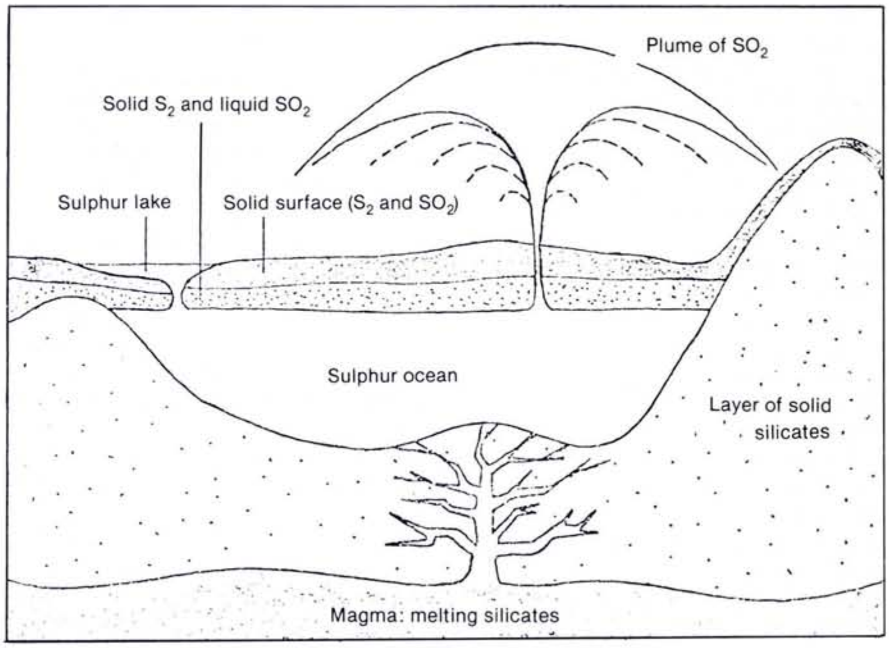

Fig. 6 — Model of the crust of Io (after B. Smith)

Other models have also been suggested but many questions remain, notably on the interface between Io and the Jovian magnetosphere. Even if Io is the source of the plasma ring, the mechanism of its formation is far from clear. How do the minute dust particles which make up the plume succeed in escaping from Io's atmosphere? In order to overcome Io's gravity, neutral particles would have to travel much faster than observed. In addition, there are certain indications that ions constituting the plasma are formed in the middle of the torus space, in which case by what process are dust particles dispersed into the torus?

Torrance Johnson, of the Jet Propulsion Laboratories, has suggested that magnetospheric electrons, bombarding minute dust particles in the volcanic plumes, could charge them sufficiently to be carried off by the sweeping Jupiter magnetic field. Once free, dust particles could break up into atoms and molecules, and become ionized. Alternatively, the plumes of Io might not be the only source of ions and a sputtering mechanism acting on the surface material of Io could be contributing; the charged particles in the magnetosphere would be rather effective in liberating atoms of sulphur and oxygen as well as sodium. This process was in fact first put forward to explain a phenomenon observed from the Earth, namely the formation of a narrow belt of neutral sodium atoms round Jupiter in the plane of the orbit of Io. Moreover, recently it has been observed that jets of matter are ejected intermittently from the disc of Io labelled with the spectroscopic line at 5890 Å that characterises sodium.

Problems of Physics in the Developing Countries of Europe

In the week before the General Conference, the Physics and Society Committee held a seminar at the Bogaziçi University aimed at exploring the problems of physicists in the less endowed areas of Europe. As the seminar was also sponsored by UNESCO, "developing" was the term employed and meant those nations that the UN indicator showed to have a standard of living below or close to a minimum level. However, it became evident that although there was a general correlation between physics activity and GNP/capita or similar indices, the parallel was by no means exact. Detailed reports were presented by a number of delegates on the state of physics in their country and whilst a low level of funding and the absence of any science policy were common complaints, others were specific to the particular region.

Portugal

Portugal's problems begin at the level of secondary education, where there has been an explosion in the school population so that experimental studies and physics in particular have suffered disproportionately. Moreover, not only have laboratory facilities always been inadequate, but physics forms simply part of a general science course, then is linked to chemistry. Only in the final year is it separate subject.

A trend towards a similar system can be observed in a number of advanced nations and these would do well to note the effects in Portugal. Few of the teachers have a physics background and so students do not feel motivated towards the subject. As a result few choose physics and, as university students are required to define their subject and are then selected by the Education Ministry on the basis of their past results, many of the students in physics are rejects from other subjects. The problem has been further aggravated by the fact that only since 1964 have degrees been awarded in physics and now, as the quality at the top tends to rise, the effect on teaching is adverse, because of the call of research. Research is restricted by inadequate buildings, equipment and administrative infrastructure, the difficulties of access to important experimental equipment and the sense of isolation that results. International cooperation does exist but almost none with the immediate neighbour Spain and participation in any international meeting is difficult because of lack of funds.

Spain

Spain with a total investment in research and development of 0.3% of its GNP is only marginally ahead of Portugal and physics would seem to have been relatively badly treated in comparison with other scientific subjects because, it was suggested, of the absence of any "friends at court" over too many years. Out of the total number of active physicists, estimated to correspond to 26/ million of the population, two thirds are concentrated in Madrid, which implies a serious starvation in the provincial universities. Solid state physics is the dominant subject which corresponds neither to the social needs of the country where perhaps the earth sciences could be more relevant — notably hydrogeology nor to the international research that is now centred in Spain, namely astrophysics. Not only is there IRAM the Institute for RadioAstronomy in the Millimetre range and the UK and German observatories in Spain itself, but there is the international astronomical centre in the Canary Islands with as partners Spain, Denmark, Sweden and the UK whilst France, Fed. Rep. of Germany and the Netherlands are proposing to establish other instruments in the region. Despite this concentration of observing equipment and the provisions for time for Spanish astronomers, no priority has been given to astrophysics in education or national policy.

In all areas, almost no money is set aside for international collaboration so that groups wanting to participate in international schemes have to find their own financial resources, despite the fact that salaries already account for over three quarters of the grants available. The position was exacerbated by the channelling of relationships through government institutes such as the atomic energy commission which further isolated the universities.

Croatia

In a detailed study made in Croatia the number of physicists per million head of population turned out to be 65 (compared with 145 in Hungary and 250 in the Federal Republic of Germany). At this low density, although some groups exceed the critical threshold in size — notably in nuclear and elementary particle physics and solid state — others in atomic, molecular and plasma physics are at a much lower level and in the rest, research is carried out by isolated individuals — if at all. The few physicists who work in industry are spread very thinly so that applied physics is far below the critical mass, and there is little support for technology. In its international relations, Yugoslavia has an association agreement with Dubna and there is some interaction with CERN at the individual level, but the most important participation is through the International Centre for Theoretical Physics (ICTP).

Turkey and Eastern Countries

In Turkey with but 0.2% of its GNP devoted to research and development, the problems were similar (see *EN*, **12** (1981) 8/9) — low funding, no science policy, primitive data handling facilities, international collaboration limited, but ICTP the most valuable.

In the planned economy countries it would seem that physics gets a rather larger slice of the cake. The figures quoted above indicate there are 1500 physicists in Hungary and the seminar heard that in Bulgaria there were 2000 in research and a further 2000 in teaching and about half these numbers in Romania. Unfortunately, the data that was provided gave little detail and, although it could be understood that there was a much greater emphasis on applied research, it was not possible to gain further insight into the situation. International links are probably more highly developed through Dubna and other joint institutes in the eastern European countries, but it could be noted that the problems of travel were not any the less and, in the larger context ICTP held a unique position.

Proposals for Amelioration

This enthusiasm for the international theoretical institute funded largely by the stronger countries (with in the case of ICTP a determining contribution at the beginning from Italy) spilled over into a desire for something similar in the experimental fields. Costs are however an order of magnitude different and the more realistic view was that we should build on the strengths that existed, although a European Synchrotron Radiation Facility could provide a new meeting ground. It was also recognized that membership in international experimental organisations was a two-edged sword. While CERN and ESA were urged to be more accommodating, it was stressed that the weaker countries, got back proportionately less from participation than the strong, as a solid base at home was a pre-requisite for an active involvement. Moreover there was the perennial risk of detached staff being lost indefinitely, which seemed to have been avoided with the types of association organized in ICTP (see *EN*, **8** (1977), 12).

Participation in collaborative programmes, both regional and international, was however, considered to be essential if physics in the developing countries was not to fall farther behind. This enabled scientists to keep in touch with the frontier subjects and to learn — as well as contribute — at the highest level. There were also side effects — industry could be brought into touch with high technology and find markets that previously were inaccessible.

Many proposals were put forward as to how the stronger countries could help, but it was pointed out that a major effort in the developing countries was also necessary; colleagues in the stronger countries needed assurances that their contributions did not result in internal resources being diverted into other channels. The proposals directly concerning EPS included:

1) the establishment and coordination of a series of summer schools that served a region and which treated topics that already had an established base;
2) an active response to the offers of scholarships, and teaching exchanges;
3) an active participation in the work of boards and committees, and especially ACAPPI;
4) nomination of specialists to the editorial boards of journals;
5) assembly of accurate and consistent data that would provide comparative figures for the input to different areas of research in terms of money and manpower, and the output in terms of the number and quality of original contributions to the literature;
6) the exercise of EPS influence to drive home to governments the need for change.

Many delegates made the point that only an outside voice is listened to, and at all levels, money is needed for travel.

The report on the Seminar will now go to the EPS Executive which will then examine the proposals together with those from the Erice seminar on career outlooks.

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