criteria which included, apart from astronomical considerations, questions like availability of water, nearness to a reasonably large city, etc. In view of the magnitude of the VLT investment, it is not clear that these last criteria should have the same weight today and a new search has been made to see if substantially better sites exist, without excluding from consideration ease of operation, infrastructure needs, or the personal comfort of the staff.

Studies have been mainly concentrated on a coastal region of Northern Chile, which seems to offer an outstanding climate, but space on the available summits is limited. Cerro Paranal — located about 150 km south of Antofagasta, a few kilometres from the coast, and at 2650 m elevation — has been monitored for more than three years and appears an excellent candidate. On the basis of presently available data, Paranal appears to be superior to any known site in the world for cloudless nights and is also extremely dry. It is a serious candidate for the VLT.

Schedule

The present plans foresee that the first telescope could be ready in 1995 and the project could be completed by the year 2000. An extensive instrumentation programme will be developed in collaboration with national astronomical institutes.

EPS Workshops

New achievements in physics not only satisfy our scientific curiosity, but can have often important technical and economic consequences. This new scheme of EPS Workshops strengthens the links between academic research and industrial development in Europe by bringing together competent representatives of both sides in special fields, where a broad collaboration is desired.

"Magneto-optical Recording" is such a characteristic field, where the creative hybridization between materials research and technical ingenuity is a decisive factor for economic success in a very competitive international market. The goal is to reach much faster, better and denser storage of information by replacing the usual combination of magnetic layers and inductive heads by modern optical devices, such as lasers, interacting with magneto-optically active magnetic materials.

Light is refracted and absorbed by matter through its interaction with the electrons present. In ferromagnetized materials, the magnetic electrons spin and rotate around parallel axes so that the optical properties are different for light waves of different polarity; a ferromagnet brought between two crossed polarizers may look dark or bright depending on the angle of its magnetization with respect to the light beam. This effect can be used for reading by a polarized laser beam the binary information stored in a magnetic tape or disk much faster and more conveniently than by small induction coils which usually need to fly at tremendous speed for very small distances over the surface. The advantages in terms of density, precision and quality of using magneto-optical techniques for recording are evident to anyone who has listened to a modern compact disk player.

The industrial realisation however of such magneto-optical devices requires the development of not only advanced optical and electronic apparatus, but also new magnetic materials, which combine the physical properties desired with a large magneto-optical activity. For this task one needs much more fundamental knowledge about the chemistry, electronic structure, magnetism and optics of magnetic alloys and compounds than can be found in the present literature.

"SQUID" are in a rather different economic category at the present time, but to exploit the potential of these low temperature quantum devices a similar meld of science and different technologies is needed and the close cooperation between academie and industry.

SQUID is an acronym for Superconducting Quantum Interference Device. Its working principle is based on flux quantization and the Josephson effect. Practically, SQUIDs are very sensitive magnetometers, working at a temperature as low as that required by the superconducting materials of which they are made. Using an inductive coupled coil, such devices can also be used as low impedance, high sensitivity ammeters. There are basically two kinds, the RF SQUID and the DC SQUID, but even if their working principles are very different, their behaviour from the point of view of the user is much the same.

For frequencies lower than about 100 MHz there is no other amplifier with such a high sensitivity to energy changes. In fact their sensitivity, *i.e.* the minimum magnetic energy detectable for unit bandwidth, is usually expressed in units of the Planck constant. Often such a device is near to the limit imposed for an amplifier by quantum mechanics and is one of the few that explicitly makes use of quantum mechanics.

In many fundamental physics experiments the SQUID is the only device that can give the sensitivity required. On the other hand, the need for low temperature and special low noise, linearizing electronics excludes its use in many applications.

The Future of Magneto-Optical Recording

Bad Honnef, 2-4 November 1987

Themes

The workshop was devoted to discussions of basic research in magneto-optics and research and development on magneto-optical recording in Europe. Some 50 people from 11 countries participated, half of whom were from industrial R & D laboratories. Of the 13 papers presented again half were from industrial R & D laboratories and half from governmental and university research laboratories.

Without going into the detail of the special presentations* we summarize here the final discussion which reflects the essential goal of the workshop: To assess the status of magneto-optical recording in Europe, compared with that in Japan and the USA.

* A limited number of copies of the presentations are available from the EPS Secretariat, price SFR 50.–.

Six central themes were identified:

1. Regional aspects:
   Japan and the others;
2. Company policy;
3. Research and Development;
4. Cooperation between basic research and industrial research and development in Europe;
5. Demands on basic research;
6. The future.

Regional Aspects

To set the scene, an overview of the international development of magneto-optical recording was given by Professor R. Carey of Lanchester Polytechnic, Coventry. According to him Japanese companies in their plans have shared out amongst themselves the future world market leaving no space for other countries. Factories are being built, research at some companies has even been finished, yet European companies are still hesitant.

In contrast, the workshop demonstrated that "basic research" as well as "research and development" in Europe is on a par in this field of recording, comparing favourably with the USA. Most basic ideas, which have led to R & D activities in magnetic materials have been created in Europe and indeed for a long time, Europe was ahead of other countries in basic research in magnetism. What has happened in the mean time?

Three opinions were expressed:

(a) The Japanese work harder than Europeans.

(b) The Japanese are considerably more agressive (while staying polite!) than European companies in fighting for market shares. Decisions in that phase are said to be made much faster in Japan than in Europe.

(c) The technology transfer and cooperation between universities and governmental institutions and industrial companies is seen to be more intensive and more efficient in Japan and the USA than in Europe, where an "interfacial problem" seems to exist. In Europe too large a gap seems to be opened between the goals and working levels on both sides.

Company Policy

Given that R & D in Europe is at the same level as elsewhere why do companies see problems in the development of the market and hesitate to share the optimism of Japanese companies? How can it happen, that only a few percent of the present market in magnetic recording systems and mass storage media is held by European companies, while all the rest is shared between Japan and the USA? In Europe investment in new technologies is very carefully balanced against the expected success, the overriding aim being to avoid too great a risk. If success becomes obvious, European companies will then want to enter the market. But — will it then be too late? Breaking in will present a formidable challenge.

The technical skills are there and a great number of ideas are waiting to be transformed into products. European laboratories have a large capability. If it can be concentrated, the ideas as well as the results of research combined, if a strategy can be devised, then European countries can mount a real challenge.

Cooperation

Cooperation is open to improvement. Many of the technological problems which arise in the development laboratories (like aging, corrosion, protection, etc.) are of minor interest for basic research, but they are vital for future products. This gap has to be closed. Examples can be found where cooperation is better such as in programmes like Esprit or EUREKA. There the links between European companies in R & D and to related research institutions have proved to be possible and can be organized as successfully as in Japan or the USA. One point should be stressed: the demands of supporting European institutions are in some cases too strong. University institutions cannot in all cases follow exactly the R & D lines of industrial laboratories. They need independent support for long term and efficient research. Some improvements may be possible in this area.

Demands on Basic Research

Industrial laboratories were asked to state their requirements. One of the main problems seems to be to find scientists, well trained in the problems of magnetism as there are only a few universities in Europe, giving special courses in magnetism. In some cases, industrial laboratories try to hire young scientists already trained in magneto-optics but they have little success.

A special although still incomplete list of present problems which should be investigated in basic research laboratories was presented by Dr. Heitmann of Philips Research Laboratory, Hamburg. These could be summarized as:

- Improvement of basic knowledge;
- Magneto-optical effects in amorphous alloys;
- Control of magnetic anisotropy;
  Molecular field parameters
- Understanding of:
  write noise,
  thermomagnetic switching,
  physical limits of thermomagnetic recording;
- Direct over-write.

The three days of presenting papers and discussing the problems were found by all participants to be very fruitful and successful.

H. Hoffmann, Regensburg
W. Zinn, Jülich

SQUID: State of Art, Perspectives and Applications

Rome — CNR, 22-24 June 1988

The workshop focussed on the main aspects of SQUID activity. The most important application of SQUIDs is in biomagnetism, for the recording of the magnetic field generated by the human body. By using many channels of detection the possibility is opened of creating a powerful diagnostic instrument that can map functional activity and localize diseases especially of the brain. This together with the planar gradiometer, fabricated with lithographic techniques will form the main thrust of developments in biomagnetism where multichannel devices with tens of devices working at the same time are required.

A new and fast growing field of application is in elementary particle physics for detecting weakly ionizing particles, such as massive monopoles and low energy neutrinos. Digital linearization which is now becoming competitive with the more traditional analogue technique can noticeably reduce the number of wires connecting the low temperature device to the room temperature apparatus.

SQUIDs based on the new high T_c materials have already reached performances as good as those employing conventional superconducting materials of twenty years ago. They are, nevertheless, still far away from practical use because multilayer lithographic techniques are not yet available, nor even true Josephson junctions. The very low coherence length makes the task of reaching this goal very difficult.