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Meeting Report

The 1980 European Optical Conference

An annual optical conference was held from 22 to 25 April 1980 at the Prémontrés Abbey, Pont à Mousson, France. It was organized by the European Optical Committee and the French Optical Committee, sponsored by CNRS (National Centre for Scientific Research) and the CNES (National Centre for Space Study). Prof. C. Imbert was the president of the organizing committee, and Prof. A. Maréchal was the president of the scientific committee of this meeting.

The conference was attended by some 270 people, of whom about 17% came from outside France. Fifteen invited papers, and 43 offered papers, delivered as lectures, and 77 communications, delivered as posters, were presented in French and English.

The title of this conference was *Horizons de l'Optique* (*Prospects of Optics*). Its main purpose was to achieve a closer intercommunication between Industry and Research; that is why the scope of the selected topics was intentionally wide. Each session gave a general view of the state of the art in the given topic, and the particular papers showed the most recent results.

The sessions were devoted to the following topics (the numbers in parentheses denote the invited papers and offered papers presented as lectures, and the communications given only by posters):

1. Optics in space research (3+22+10).
2. Lasers
   i) application to biology and medicine (1+0+6),
   ii) high power lasers or high energy lasers and their applications (1+3+7).
3. High speed phenomena, and high speed cinematography (3+3+8).
4. Guided optics and integrated optics (1+5+11).
5. Optical techniques of industrial testing (1+4+19).
6. Solar energy and its utilization (1+4+4).
7. Infrared imagery and far infrared (4+2+12).

This list shows that the space optics was represented by the greatest number of papers. Three invited papers gave a large review of optical instruments and systems which are used for celestial spectrography, metrology, teledetection, observations of the sky or the earth from space, and for recording images of astronomical and terrestial objects. Some constraints in design of optical instruments for the space research were also discussed. The first constraint concerns mass which should be the smallest possible. To meet this demand light-weight mirrors for space telescopes have been constructed. In Europe, such mirrors are produced from a solid glass block in form of a "honeycomb" structure by an ultrasonic machining process (e.g. Matra technique) or by drilling the back side of the mirror (REOSC technique). These techniques enable to reduce the mass of the blank up to 70%. In U.S.A. (Corning Glass of Elmira) another procedure has been developed, namely glass segments are fused to form a light-weight mirror blank. The technique is based on the near zero coefficient of expansion of the material used (ULE); this material reduces the stresses during the fusion.

The second constraint refers to the volume of optical system. In this respect the aspheric optics offers better possibilities as it enables a drastic reduction of the total numbers of elements even in high performance optical systems.

Another constraint is related to stability. High differences in luminous flux received by the instrument from the sun, earth and deep space would produce significant temperature gradients, unless careful attention is paid to thermal properties and conductance of materials. In order not to exceed optical tolerances, the materials selected should have very low coefficients of expansion, as Invar or carbone fibre; e.g. a 2 meter long optical bench, which has been constructed recently by the European Space Agency (Holland) for the NASA 2.4 m space telescope ("Orbiter 03" program), has the coefficient of thermal expansion less than 2×10^{-7}. This optical bench is made from a carbon fibre reinforced plastic. The planned spatial resolution of the said space telescope is less than 0.007 arc sec during 24 hour exposures. This means that the image stability in the faint object camera should be of the order of 1 μm during a 10 hour exposure.

There are many other constraints, e.g. caused by steady and random accelerations, acoustic excitation during launching the space shuttle, and the absence of gravity in the orbit which impose sophisticated and unprecedented design solutions for space optical instruments. Some of these solutions are already realized to be applied to different space projects ("Spacelab", "Orbiter 03", "Hipparcos", SPOT, "Saliout 7").

It is worth mentioning that in the space research a great attention is being paid to optical instruments and facillities for IR and UV spectral regions. For instance, a Schmidt type telescope for "Spacelab" is built in France (Observatoire de Marseille), Italy (Asiego Astrophysical Observatory, University of Padova), and U.S.A. (Perkin-Elmer), the ultimate goal of which is to provide the astronomers with a UV atlas of the whole sky comparable in image quality to the Palomar Schmidt survey.

The session *Optics in Space Research* has shown that the French activity in this field is well developed, and that there exists a close cooperation among France, Holland, Italy, and Belgium (through NASA, European Space Agency, Centre National d'Etudes Spatiales, and other agencies).

As far as the second sessions is concerned it is worth noticing that it was a French session. Only one (invited) paper was given by a foreign lecturer (R. Sigel, West Germany). He spoke on thermonuclear fusion by high power lasers (100 TW regime), giving a particular emphasis on the interaction problem and its implication for the wavelength of the laser, as well as on the existing high-power laser installations and the trends in the future laser development. The offered papers and communications were devoted to laser photochemistry and isotopic separation, some optical problems of high power Nd-glass lasers with pulses 100 ps–10 ns, new research for improving VIS and UV pulse lasers, interactions of different laser wavelengths with matter (it has been stated that UV wavelengths are better for the thermonuclear fusion than VIS wavelengths or near IR wavelengths), recent progress in optical levitation, and the possibility of application of this phenomenon to support glass microballoons used in thermonuclear fusion experiments, high power dye lasers, thin films for high energy lasers, and other problems. The above problems were discussed in the sub-session *b*, whereas the sub-section *a* dealt with laser surgery and laser chemical analysis.

The laser session was closely related to the next one in which two review papers dealt with different techniques and applications of high speed photography, the remaining ones being devoted to the production of ultrashort laser pulses (between nanosec. and picosec.) and their applications to diagnostics of high speed phenomena (especially occurring in laser–plasma interaction), and to picosecond spectroscopy. During this session an interesting film on civil applications of high speed photography was presented.

The main speaker of the fourth session was E. Spitz from Central Research Laboratories of the Thompson-CCF, Corbeville, France. His paper reviewed the great progress

which has been achieved in guided waves and optical communications since 1965. According to him the future of optical communications lies, however, in single mode fibres. Particular papers and posters of this session dealt with new materials for optical fibre technology, new manufacturing techniques, holographic connectors and couplers for fibre optics, light sources and detectors for optical telecommunication, information transmission through fibres by wavelength multiplexing, transmission of the IR wave of the length of 2 to 11 μm, nonlinear effects in guided waves, Raman scattering in optical fibres, and other phenomena. Some problems of planar integrated optics were also discussed.

The fifth session included mainly papers and communications on laser and holographic interferometry (also with heterodyne action), speckle interferometry, moiré techniques, and laser Doppler velocimetry. The paper presented by R. Dändliker from the University of Neuchâtel, Switzerland, was of a greatest practical importance. The lecturer spoke about a laser interferometer which measures length, straightness, tilt and rotation by fixing the adequate reflecting optical elements to machine parts under test, as well as about a heterodyne speckle interferometer which measures in-plane and out-of-plane displacements and vibrations of objects with diffusely scattering surfaces. The latter has a high local and temporal resolution and is, in particular, well suited for the study of microvibrations with amplitudes down to 1 nm and frequencies up to 10 MHz.

An interesting and useful lecture was given by J. Ch. Viénot from the University of Besançon, France, devoted to the quality assessment of surfaces in white light. The lecturer discussed, in particular, coherence properties of the inspecting light beam, channalled spectra and temporal holography, image spectrograms, and temporal speckling.

Valuable contribution on profile testing with computer moiré grids was also given by A. W. Lohmann and Lu Po-shiang (University of Erlangen, West Germany). In profile testing with moiré, two gratings are commonly used. In general, the both gratings (or at least one of them) have equidistant parallel lines. This, however, may lead to difficulties in interpretation of the moiré fringes and to non-uniform sensitivity across the profile under test (e.g. a sphere). These constraints can be overcome by using curved gratings performed under computer control.

The sun is potentially the greatest source of useful energy for the inhabitants of the Earth. Some possibilities and projects of the solar energy conversion were the subject of the sixth sessions. The main and economically well-founded paper was presented by J. Robieux (Scientific director of the Marcoussis Laboratories, Research Centre, Compagnie Generale d'Électricité, France). He discussed different means of solar energy conversion into thermal energy and electric power, the major emphasis being given on solar collector and concentrators, storage and transmission of heat, and on other problems. Some designs of high power solar stations were also described. Other lecturers spoke about photovoltaic solar energy utilization, selective coatings for heliothermal energy conversion, and about physical and biological principles of photosynthesis. This session has shown that optics applied to solar energy conversion is in a progress.

A review lecture on the recent (but well known) progress in infrared technology and its applications was given by A. Hadni (University of Nancy, France) at the beginning of the final session. Next, F. K. Kneubühl (ETH Zürich, Switzerland) spoke about waveguiding in longitudinally and transversaly excited, as well as optically pumped far-infrared gas lasers. The theory and the first operation of an optically pumped distributed-feedback gas laser were also presented. This session included, moreover, some applications of the optoacoustic effect in the infrared, especially to

laser spectroscopy in far infrared, Fourier spectroscopy by combining an optoacoustic cell with an interferometer, and to production and processing of optoacoustic images. Quantum detectors for a range of 8 to 13 μm, those developed by Thompson-CCF France, have been also described by a lecturer.

Posters of this session covered some applications of the far infrared in the study of different crystals and the properties and utilization of the Kodak photoresist KMR-747 in the infrared range 2 to 10 μm. A multiband array photometer for far infrared astronomy, a transformer of infrared (thermal) images, an IR camera with a liquid crystal, a TV camera for near infrared, and a scanning Fabry-Pérot interferometer for far infrared were also presented.

The organization was excellent in all respects, including different facilities of the Prémontrés Abbey. The participants received a large volume of abstracts, which – with a few exceptions – were of a good standard.

The annual session of the European Optical Committee (EOC) was held during the third day of the conference. The participants have decided that the 1983 European Optical Conference will be held at the SIMP Conference Centre in Rydzyna, Poland, probably on the last decade of May. Rydzyna – sitated between Wrocław and Poznań – is a nice little town with a beautiful palace, recently restored and transformed into the conference centre. The EOC approved unanimously the title of the 1983 European Conference, namely: *Optics in Science and Practice.* A detailed programme will be submitted for acceptation to the next annual session of the EOC, which will be held in Graz (Austria) during the XII Congress of the ICO.

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