GENERAL SUMMARY OF THE CONFERENCE

J. Ring

To cite this version:


HAL Id: jpa-00213248
https://hal.archives-ouvertes.fr/jpa-00213248
Submitted on 1 Jan 1967

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers. L’archive ouverte pluridisciplinaire HAL, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d’enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.
GENERAL SUMMARY OF THE CONFERENCE

by J. Ring

Department of Applied Physics University of Hull, England

Introduction. — It is never easy to summarise the proceedings of a scientific conference. The task increases in difficulty in direct ratio to the success of the conference — one is in danger of being so stimulated by a profusion of new ideas that he cannot see the wood for the trees.

Fellgett has dealt so ably with multiplex techniques that it would be presumptuous of me to consider them further; I shall therefore confine my remarks to the later papers; even so it is impossible to mention every elegant new technique or application and I hope that no-one will feel that his work has not been heeded if it is not included here.

Fabry-Perot techniques. — Tremendous progress has been made in this field since the conference in 1957 when Jacquinot and this colleagues astonished all of us with the possibilities implicit in a realisation of the meaning of "resolution-luminosity" product. Workers in such vastly different fields as atomic physics and astronomy have seized upon the elegant simplicity of the Fabry-Perot interferometer and have pushed its flux-gathering powers almost to the limit. Dissatisfied with the gain in luminosity in the central fringe we find that Hirschberg, Katchen et al, Ben Mena and Shepherd have succeeded in obtaining a further increase of up to an order of magnitude with their multichannel instruments. In addition to their high luminosity, these instruments permit simultaneous observation of several spectral elements — of vital importance when the source fluctuates in intensity. Chabbal refuses to be content until he is able to observe thousands of orders simultaneously and with the photographic and electronographic versions of SIMAC he and his colleagues are close to the ultimate spectrograph. We must now be careful to distinguish between spectral and spatial multichannel instruments — if both can be combined will any further refinement be possible? Courtès, Cruvellier, Henderson, Shepherd and Clarke have employed the simple Fabry-Perot interferometer in Astronomy to obtain spectra of sources which are too faint for grating instruments. One imagines that these applications of the interferometer would have particularly pleased its inventors.

At the 1957 Bellevue conference there was much discussion over the best method of varying the path difference of a Fabry-Perot monochromator. We heard little in 1966 about this topic, but it was most impressive to see the results of automatic control of path-difference and of parallelism in the papers of Ramsay and Laube. Whilst it is comforting to realise that multiple-beam interferometers still possess an advantage over Fourier types in that they do not, in general, require such an accurate knowledge of path difference, it can be disconcerting to find that one has obtained spurious data, because of changes in instrumental finesse (and hence profile) during a scan. Servo-control should now eliminate this possibility and its use should be seriously considered by all of us. Another significant contribution to the technique is in the improved methods of recording and processing data, described by Steudel and by Huehnermann. One meets here the same problem as in the Fourier spectrometer — should one use step-by-step path difference variation with digital recording (photoelectron counting) or vary the path difference continuously with analogue recording (D.C. amplifier). It seems likely that as increasing use is made of computer processing of spectra, the former method will become more convenient.

Multilayer films are now taken for granted and we heard much less about them than we did in 1957. But Bradley and Neilson described their work on ultraviolet reflectors and filters — we can now extend the wavelength range over which Fabry-Perot interferometers can be used. James and Loewenstein discussed the properties of multilayers for use as beam-splitters in the far infra-red, convincing us that much remains to be done in the field of thin films. Perhaps the greatest problem remaining in Fabry-Perot instruments is to obtain flatter plates, since coatings are now available with very high reflectivity, and low absorption. Duong et al described a rapid method for displaying surface defects — all of us will benefit if their work results in smoother flats, but progress with this problem is fraught with difficulty.
A severe limitation still remains in Fabry-Perot instruments. They have been used at very high resolution on isolated emission lines (micro-Kaisers have become the practical unit), and at low resolution on continuous spectra with a variety of pre-monochromators. High resolution of a continuous spectrum is still difficult if one wishes to take full advantage of the luminosity of large flats. PEPSIOS, described by Roesler, offers one possible solution to this problem. Although at first sight it seems a complicated system, there are still those of us who are reactionary enough to enjoy using a grating. Perhaps Fellgett and Mertz are correct in claiming that the outstanding advantage of multiplex interferometers is their simplicity, but there will always be lazy individuals who will be happy to buy standard path differences ruled on glass blanks, rather than be faced with the problem of constructing an interferometer as accurate as the grating ruling engine. Those of us in that category can take heart from the steady progress in endowing grating spectrometers with high luminosity and even multiplex advantages. The «Mock» interferometer has been mentioned by Fellgett but the selective modulation technique is equally promising. Girard described the possibilities of his system, which is now available commercially in a highly developed form and Verges and Morrillon discussed applications of SISAM in the near infra-red. Bouchareine and Jacquinot have ingeniously adopted the Girard system to a spectrograph with the consequent advantage of simultaneous recording of many spectral elements. These instruments cannot show the same theoretical gain in signal-to-noise ratio as can the multiplex techniques but their simplicity makes them very attractive in a number of applications. (The Bouchareine-Jacquinot method is particularly well-suited to astronomical observation of faint extended sources in the visible.) Neill's version of the Golay multi-slit is very interesting and there is little doubt that for some applications this method will be preferred to interferometric ones. It is comparatively easy to modify Neill's instrument to make it multiplex (but not interferometric or Fourier). Orthogonal codes of the Golay type have had much less investigation than the Fourier method — there is a strong case for further research into their possibilities.

**Laser methods.** — A topic which received no mention in 1957 may well prove to be one of the most important to be discussed in 1966. The application of lasers to spectrometry has been predicted for several years, but it is now beginning to take practical shape. Stroke gave us a new insight into the significance of holography to spectrometry, whilst Besson hinted at intriguing prospects of tuning lasers by pressure. Since the laser is both source and monochromator, what is its resolution-luminosity product and on what does it depend?

The paper by Vetter and Brochard was a most important one. If anyone missed its significance at the time it was presented (the present author, in an intellectually-saturated state certainly did), he should read the published version carefully. Their technique, when perfected, will be as complete an answer to some line-profile problems as we can hope to achieve.

**General conclusions.** — When Fellgett summarised multiplex methods at the mid-point of the conference, some people began to despair. The magnificently accurate instrumental profiles of the two-beam interferometer, the possibilities of field-widening and the multiplex advantage made one wonder if all other spectrometric methods were not obsolete, so great had been the development of the method. But as the conference progressed, gloom gave way to elation as one realised that equal progress was being made in other directions and that entirely new techniques were emerging. There is still room for all of us in the science of spectrology (to support Fellgett's term). The multiplex interferometer must be simplified if it is to gain widespread acceptance, whilst the other methods must be refined if they are to rival its precision. We must consider each problem carefully before deciding which of the many instrumental methods is best suited to it.

Above all, we must teach these new concepts in instrumental spectrology to our students and our colleagues. The pace of progress has been so rapid that there are no suitable text-books and the literature is too disperse for the beginner. The publication of these proceedings will serve to enlighten the novice as well as to enrich the accomplished.

This summary is necessarily brief and may have many shortcomings. Should this be too obvious, the reader is invited to re-read the first paper where Jacquinot, with his customary lucidity, summarised the conference before it began! (1)

(1) Cette dernière phrase fait allusion à l'exposé d'introduction de P. Jacquinot, qui n'a pu être publié.