14. FUNDAMENTAL SPECTROSCOPIC DATA
(DONNÉES SPECTROSCOPIQUES FONDAMENTALES)

PRESIDENT: A. H. Cook.
VICE-PRESIDENT: R. H. Garstang.
ORGANIZING COMMITTEE: G. Herzberg, W. Lochte-Holtgreven, M. V. Migeotte, Ch. Moore-Sitterly, J. G. Phillips, R. Tousey.

SCIENTIFIC PRIORITIES

The priorities of work in the fields covered by Commission 14 are determined by the needs of other astronomers, for the aim of Commission 14 is to ensure that data are available by which astronomical observations may be interpreted in physical terms. Thus, there is a continuing need for precise measurements of standard wavelengths so that lines observed in astronomical spectra may be interpreted in terms of spectra of atoms or molecules studied in the laboratory. Until recently, only visible spectra were observed in astronomy, but it may be expected that in the next decade there will be a growing need for standard measurements of frequencies (or wavelengths) of lines in the radio, ultra-violet and X-ray regions of the spectrum.

Transition probabilities and cross sections for various processes are needed to interpret physical conditions in astronomical sources, and here again, it is probable that there will be a growing demand for data relating to transitions at energies corresponding to radio, ultra-violet and X-ray spectra.

Following the XIV General Assembly of the Union, IAU Colloquium No. 8, on *Experimental Techniques for Determination of Fundamental Spectroscopic Data* was held in the Physics Department of Imperial College, London (**1**).

REFERENCE

1. Shore, B. 1971, *Q. J. R. Astron. Soc.*, **12**, 48–60.

A. H. COOK
President of the Commission

COMMITTEE 1: STANDARDS OF WAVELENGTH

The primary standard

Great progress has been made in the work on stabilizing laser transitions by tuning to sharply defined molecular absorption lines. Several such transitions in the visible and infrared have been investigated, and their wavelengths have been measured with reference to the ^{86}Kr primary standard. For the infrared methane-stabilized helium-neon laser line, Barger and Hall (**1**) find $\lambda_{vac} = 33922{\cdot}31376 \pm 0{\cdot}00012$ Å, the error limits being set by the properties of the primary standard. The intercomparison of the different laser lines can be made with much higher precision.

By a remarkable development in frequency measurements it has become possible to compare optical frequencies with that of a caesium beam oscillator, the present standard of time interval. The frequency of the methane-stabilized transition at 3·39 μm was thus determined by Evenson and co-workers, and by combining the result with the wavelength for the same transition they obtain (**5**) for the velocity of light $c = 299792{\cdot}4562 \pm 0{\cdot}0011$ km s^{-1}. The quoted figures have been communicated by Kessler. Similar results have very recently been obtained at the National Research Council, Ottawa and at the National Physical Laboratory, Teddington. This development

https://doi.org/10.1017/S0251107X00024494 Published online by Cambridge University Press

opens up a possibility of replacing the length standard by an adopted value of c, chosen so as to reproduce the present ^{86}Kr standard within its limits of precision. This question has been discussed in a comprehensive review by Cook (**2**).

Secondary standards

The wavelengths of 34 lines in ^{86}Kr I between 5563 and 9755 Å, emitted by a microwave-excited electrodeless lamp, have been measured by Eriksson and Norlen (**4**). They derive a system of energy levels valid for this kind of light source. For levels of the configuration 5*s*, 5*p* and 6*p* the results are practically identical with those derived by Kaufman and Humphreys (**9**), while for 7*s*- and 6*d*-levels there is a small systematic difference. The measurements by Czerwonka *et al.* on 9 infrared lines of ^{86}Kr I, mentioned in the previous report, have now been published (**3**). A paper by Humphreys and Paul (**6**) summarizes all their results on ^{86}Kr I and ^{86}Kr II.

Humphreys and Paul (**7**) have published the results of covering the region from 3949 to 35079 Å, and give a set of energy levels derived from these measurements. The same authors report in (**8**) their interferometric measurements on 108 lines of ^{136}Xe II from 3800 to 6500 Å and relative values of the energy levels involved.

F. P. J. Valero (**10**) has made some interesting comments on the derivation of the Th I Ritz standards.

The comprehensive compilation of standard wavelengths that was mentioned by V. Kaufman at the 1970 meeting of this Commission is expected to be available by the time of the forthcoming meeting.

REFERENCES

1. Barger, R. L., Hall, J. L. 1973, *Appl. Phys. Lett.* **22** (in press).
2. Cook, A. H. 1972, *Rep. Prog. Phys.*, **35**, 463.
3. Czerwonka, R., Giacomo, P., Hamon, J. 1970, *Metrologia*, **6**, 74.
4. Eriksson, K. B. S., Norlen, G. 1970, *Physica Scripta*, **1**, 247.
5. Evenson, K. M., Wells, J. S., Peterson, F. R., Danielson, B. L., Day, G. W., Barger, R. L., Hall J. L. 1972, *Phys. Rev. Letters*, **29**, 1346.
6. Humphreys, C. J., Paul, Jr., E. 1970, *J. Opt. Soc. Am.*, **60**, 200.
7. Humphreys, C. J., Paul, Jr., E. 1970, *J. Opt. Soc. Am.*, **60**, 1302.
8. Humphreys, C. J., Paul, Jr., E. 1970, *J. Opt. Soc. Am.*, **60**, 1454.
9. Kaufman, V., Humphreys, C. J. 1969, *J. Opt. Soc. Am.*, **59**, 1614.
10. Valero, F. P. J. 1970, *J. Opt. Soc. Am.* **60**, 1675.

B. EDLÉN
Chairman of the Committee

Stabilized lasers and the speed of light

Since the last meeting of Commission 14, sufficient progress has been made in the development of stabilized lasers clearly to indicate the probability of a change in the definition of the metre. Such a change may be adoption of a new definition tied to a stabilized laser wavelength. Alternatively, in view of recent success in optical frequency measurement, one can contemplate unifying the time interval and displacement standards while assigning a conventional value to the speed of light. In this case, the stabilized laser would have the fiduciary role of furnishing an approximate realization of the 'light-second' rather than the 'metre'. The type of stabilized laser considered for either application is one which a laser transition has an accidental coincidence with a sharp absorption line in a neutral species, and the wavelength of the laser is tuned to the centre of this absorption profile.

Several such laser systems have been investigated. One, that designed to employ the coincidence of a line of the helium-neon laser with the 3·39μ absorption line of methane, has been extensively studied by Hall and Barger (**1**) at NBS Boulder. Its stability, relative to identical systems, has been

https://doi.org/10.1017/S0251107X00024494 Published online by Cambridge University Press