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THE SECOND INTERNATIONAL TOPICAL MEETING ON PHOTOACOUSTIC SPECTROSCOPY: AN INTRODUCTION

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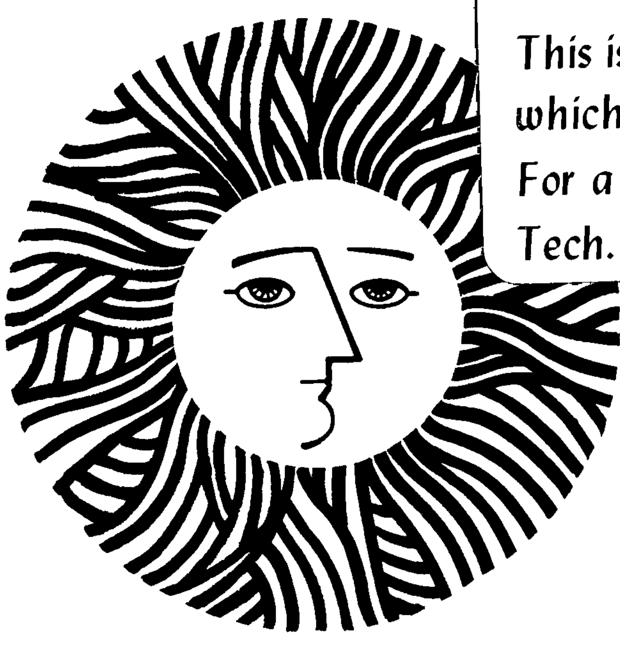

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The Second International Topical Meeting on Photoacoustic Spectroscopy: An Introduction

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ABSTRACT

The Second International Topical Meeting on Photoacoustic Spectroscopy is introduced and the photoacoustic effect is briefly described.

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The Second International Topical Meeting on Photoacoustic Spectroscopy was held at the University of California, Berkeley, June 22-15, 1981. Nearly one hundred papers were presented at the conference which was attended by over one hundred and fifty scientists from sixteen countries.

Before preoceeding with my brief review of the conference, a quick overview of photoacoustic spectroscopy and detection is in order. Although the photoacoustic effect, sometimes known as the optoacoustic effect, was discovered in the 1880's by, among others, such notables as Alexander Graham Bell(1), Wilhelm Röntgen(2), and John Tyndall(3), only during the past decade has the full potential of this effect been fully realized, and not unlike the cases of Raman and Brillouin spectroscopies, the availability of lasers is greatly responsible for the renewed interest in this effect(4). Another factor is perhaps the environmental awareness of the 1970's and the corresponding need for sensitive and "simple" detectors for monitoring air pollution.

The physical principle underlying the photoacoustic effect is that when an intensity-modulated light beam is absorbed by a given medium (gas, liquid, or solid), part or all of the optical excitation energy will be converted into heat. The generated heat is either coupled to a non-adsorbing gas and the time-dependent pressure fluctuation is detected with a suitable microphone; or, the absorption-induced heating causes the sample itself (typically condensed matter in this case) to develop thermal stresses and strains which can be detected with a piezolectric transducer.

Clearly then this technique enables the measurement of extremely small absorption coefficients and provides a unique tool for the investigation of non-radiative processes in matter. Another attribute of photoacoustic spectroscopy is that it yields information on the thermal properties of a given sample. These types of measurements provided the common denominator for the conference presentations which ranged from the investigation of basic processes in matter to applying photoacoustic detection for the characterization and non-destructive testing of materials. The papers published in this volume attest to that.[5]

The conference sessions were organized around the following themes:

1. The physics of photoacoustic detection.
2. Experimental methodology.
3. Photoacoustic spectroscopy of noncondensed matter.
4. Photoacoustic spectroscopy of condensed matter.
5. Imaging and materials characterization.
6. Photochemistry and photobiology.

Three main trends emerged from this conference:

1. Our understanding of the physics of photoacoustic signal generation has certainly matured, and now, as already evident from the conference presentations, photoacoustic spectroscopy can be employed to probe and understand matter.

2. Photoacoustic imaging and microscopy, with its unique depth-profiling capability, is a potent tool for the non-destructive testing of materials.

3. Photothermal deflection spectroscopy[6], a variant of photoacoustic spectroscopy, may prove to be a highly versatile and flexible technique which may overcome some of the limitations of photoacoustics.

In retrospect, and judging by the excitement and degree of interaction among the participants, the conference was a success. This is undoubtedly due to the efforts of the Technical Program Committee, the expert support of the Optical Society of America, our sponsors, and above all the participants themselves.

References

(1) A.G. Bell, Am. J. Sc. 20, 305 (1880); Philo. Mag. 11, 510 (1881).

(2) W.C. Röntgen, Philo. Mag. 11, 308 (1881).

(3) J. Tyndall, Proc. Roy. Soc. London 31, 307 (1881).

(4) In many cases, incoherent broadband light sources have proven to be an adequate source of optical excitation.

(5) A digest of all the papers presented at the Conference can be obtained from the Optical Society of America, 1816, Jefferson Place, Washington, DC 20036.

(6) W.B. Jackson, N.M. Amer, A.C. Boccara, and D. Fournier, Appl. Opt. 20, 1333 (1981), and references therein.

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