Differential Optical Absorption Spectroscopy

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U. Platt · J. Stutz

Differential Optical Absorption Spectroscopy

Principles and Applications

With 272 Figures and 55 Tables

Springer

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Preface

Light is the essential source of information about the surrounding world for most of us. We see objects of different brightness and colours, or, in scientific terms, we distinguish objects by the way they reflect light of different wavelengths with varying efficiency. It was exciting for both of us to learn that scientific instruments can expand our senses and provide information from this very same radiation that goes far beyond the simple recognition of objects. The ability to "see" the composition of the air surrounding us and above our heads, to us and others, one of the most fascinating aspects of the application of modern technology to study the atmosphere. This fascination drove many of the applications of the Differential Optical Absorption Spectroscopy (DOAS) method presented in this book, and continues to be the motivation for many current developments.

DOAS is an elegant and powerful analytical method to study the atmosphere and is based on the relatively simple principles of classical absorption spectroscopy. It has therefore always been quite surprising to us that this method has not found wider use in atmospheric research and air-quality monitoring.

We have introduced many university students and researchers to DOAS, often wishing that we could improve our efforts with a comprehensive text that describes both the theoretical basis and the practical applications of the method. Through our collaborations with air-quality monitoring agencies, we also realized that few of our partners had a deeper understanding of the requirements and the benefits of this method, explaining why DOAS was not considered as an air-quality monitoring technique by these agencies.

Many of the principles of DOAS and examples of scientific applications have been published in the literature over the past three decades, while some of the basics such as hardware and software design can be found only in unpublished documents or have been communicated orally in the few research groups specializing in this method.

Over the years it has become clear to us that the lack of a comprehensive text was an obstacle to the advancement of DOAS. This book emanated from

the desire to provide such a text for students, researchers at universities and in industry, as well as air-monitoring agencies wishing to employ this method.

The development and first application of DOAS dates back more than 30 years. We would like to thank the large number of colleagues who have made contributions to the improvement of the method and the development of new uses over the years. In particular, we want acknowledge Dieter Perner, with whom Ulrich Platt first introduced the idea of DOAS, and Dieter Ehhalt, who supported this new development. Fruitful discussions with John Noxon, who had similar ideas at the time, lead to improvements in this method. John Burrows, who so stubbornly and resourcefully pursued the idea of DOAS in space and trusted us that it would work, deserves much of the credit for the development of satellite DOAS instruments. We are also in debt to Jim Pitts and Paul Crutzen, who immediately saw the potential of the technique. This book would have been impossible to write without the help of all the students and researchers who have worked in our groups. Among them we would like to single out Gerd Hönninger, who played a crucial role in the development of the MAX-DOAS technique, and who tragically passed away during a research visit to Alaska. We would also like to thank Yasmine Stutz, who helped us in the preparation of this book.

Finally, and most of all, we would like to thank our families for their continuing support and great patience with us.

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