

UNIVERSIDAD DE GRANADA
FACULTAD DE CIENCIAS
DEPARTAMENTO DE FÍSICA APLICADA
GRUPO DE INVESTIGACIÓN DE FÍSICA DE LA ATMÓSFERA - IISTA

**Exploring aerosol-cloud interaction in the
atmospheric column using improved remote
sensing methods**

PhD. Dissertation

María Soledad Fernández Carvelo

PhD candidate

Universidad de Granada

Thesis director: Cat. Lucas Alados Arboledas

Catedrático de la Universidad de Granada

Thesis director: Dr. Juan Antonio Bravo Aranda

Profesor Titular de la Universidad de Granada

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Tribunal nombrado por el Magfco. y Excmo. Sr. Rector de la Universidad Politécnica de Madrid, el día ____ de _____ de 202X.

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Secretario: PhD jury committee 2.

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Suplente: PhD jury committee 6.

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Realizado el acto de defensa y lectura de la Tesis el día ____ de _____ de 202X en la E. T. S. Ingenieros Industriales.

CALIFICACIÓN:

EL PRESIDENTE

LOS VOCAL

EL SECRETARIO

The research leading to this doctoral dissertation has received funding from the following programs.

Abstract

Abstract (English version).

Resumen (Spanish)

Resumen (versión en español).

Acknowledgements

Time to say thank you!

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Abbreviations

EOA Example of Abbreviation.

Part I

INTRODUCTION

State of the art

Background of your work.

This is an example of a reference (Croff 1983).

Objectives of this Thesis

Main goals and contributions arising from this Thesis.

Layout of this Thesis

This Thesis is divided into five Parts, with several related Chapters in each of them. Firstly, Part I establishes the framework and background of this Thesis and presents the original contributions and outcomes.

Part ?? corresponds to the description of the fundamentals that applies to this work...

Part II

FUNDAMENTALS

Atmosphere structure and properties

Radiation-atmosphere interaction

- 6.1 Elastic scattering
- 6.2 Extinction
- 6.3 Raman scattering
- 6.4 Absorption
- 6.5 Radiative transfer equation

Atmospheric aerosol characterization

Atmospheric aerosol properties

8.1 Optical properties

8.2 Microphysical properties

Lidar technique

- 9.1 Principle and equation
- 9.2 Aerosol intensive properties
- 9.3 Elastic and inelastic lidar retrievals
- 9.4 Depolarization lidar
- 9.5 Fluorescence lidar

Part III

INSTRUMENTATION

ALHAMBRA lidar system

10

Setup and calibration

- 11.1 Overlap function retrieval
- 11.2 ND Filter optimization
- 11.3 Depolarization optical elements adjustment
- 11.4 Vibrational and rotational Raman channels
characterization
- 11.5 Bandwidth filter fluorescence channel calibration
- 11.6 Spectrometer coupling fluorescence channel
characterization

Quality Assurance tests

12.1 Rayleigh-fit

12.2 Telecover

12.3 Depolarization calibration

12.4 Zero bin

Part IV

METHODOLOGY

Lidar data preprocessing

13.1 Dead time correction

13.2 Trigger delay correction

13.3 Background subtraction

13.4 Overlap correction

13.5 Analog and photocounting signals gluing

13.6 Near- and far-field signals gluing

Let's include Figure 13.1 as an example.

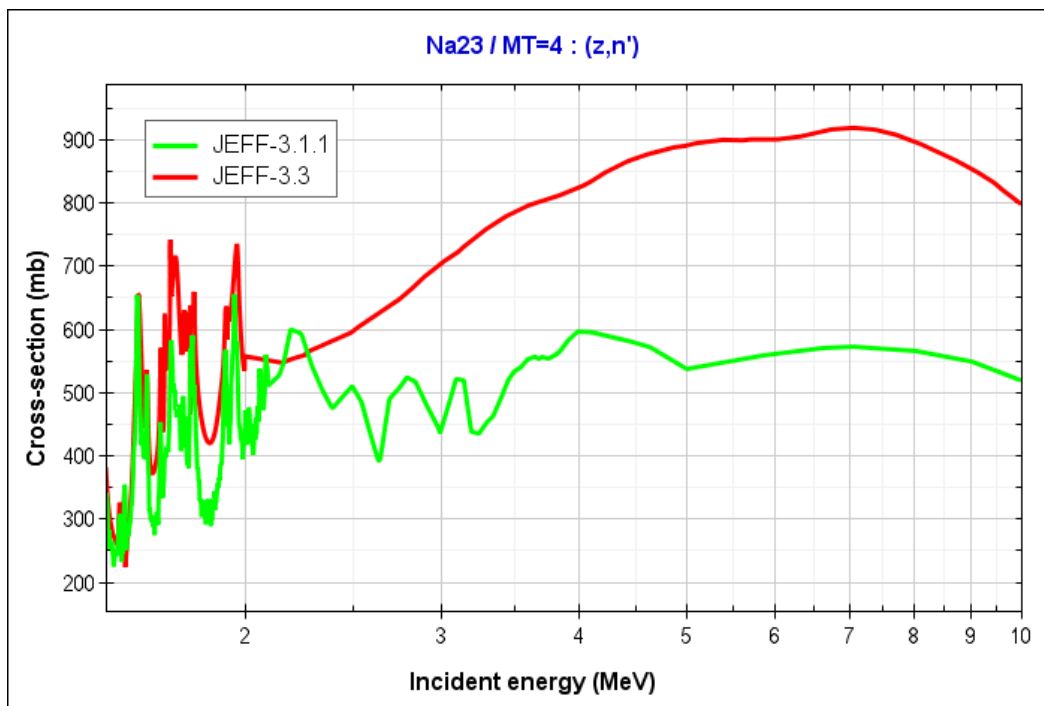


Fig. 13.1.: Figure caption.

Conventional lidar data processing

Let's include Table 15.1 as an example.

Tab. 14.1.: Table caption.

X1	X2	X3	X4	X5
Y1	XY1	XY2	XY3	XY4

15.1 Bandwidth filter fluorescence channel measurements

15.2 Fluorescence spectra measurements

Let’s include Table 15.1 as an example.

Tab. 15.1.: Table caption.

X1	X2	X3	X4	X5
Y1	XY1	XY2	XY3	XY4

Part V

CONCLUSIONS AND FUTURE WORK

Conclusions

16

Conclusions and main outcomes of work carried out in this Thesis.

Future work

As a continuation of the work carried out in this Thesis, the following lines are identified for further research.

Bibliography

Croff, A. G. (1983). "ORIGEN2: A Versatile Computer Code for Calculating the Nuclide Compositions and Characteristics of Nuclear Materials". In: *Nuclear Technology* 62.3, pp. 335–352. DOI: 10.13182/NT83-1 (cit. on p. 3).

APPENDIX

A

A.1 APPENDIX I

