

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.

Vocal: PhD jury committee 3.

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Suplente: PhD jury committee 6.

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Reviewer 1, Institution, Country.

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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!

Contents

I	INTRODUCTION	1
1	State of the art	3
2	Objectives of this Thesis	5
3	Layout of this Thesis	7
II	FUNDAMENTALS	9
4	Aerosol and climate	11
5	Atmosphere structure and properties	13
6	Radiation-atmosphere interaction	15
6.1	Elastic scattering	15
6.2	Extinction	15
6.3	Raman scattering	15
6.4	Absorption	15
6.5	Radiative transfer equation	15
7	Atmospheric aerosol characterization	17
8	Atmospheric aerosol properties	19
8.1	Optical properties	19
8.2	Microphysical properties	19
9	Lidar technique	21
9.1	Principle and equation	21
9.2	Aerosol intensive properties	21
9.3	Depolarization lidar	21
9.4	Fluorescence lidar	21

III INSTRUMENTATION	23
10 ALHAMBRA lidar system	25
11 Setup and calibration	27
11.1 Overlap function retrieval	27
11.2 ND Filter optimization	27
11.3 Depolarization optical elements adjustment	27
11.4 Vibrational and rotational Raman channels characterization	27
11.5 Bandwidth filter fluorescence channel calibration	27
11.6 Spectrometer coupling fluorescence channel characterization	27
12 Quality Assurance tests	29
12.1 Rayleigh-fit	29
12.2 Telecover	29
12.3 Depolarization calibration	29
12.4 Zero bin	29
IV METHODOLOGY	31
13 Lidar data preprocessing	33
13.1 Dead time correction	33
13.2 Trigger delay correction	33
13.3 Background subtraction	33
13.4 Overlap correction	33
13.5 Analog and photocounting signals gluing	33
13.6 Near- and far-field signals gluing	33
14 Lidar data analysis	35
14.1 Elastic backscatter and inelastic retrievals	35
14.2 Depolarization retrieval	35
15 Bandwidth filter fluorescence retrieval	37
V CONCLUSIONS AND FUTURE WORK	39
16 Conclusions	41
17 Future work	43

BIBLIOGRAPHY	45
A APPENDIX	47
A.1 APPENDIX I	47

List of Figures

13.1 Figure caption. 34

List of Tables

14.1 Table caption. 35

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 Depolarization lidar
- 9.4 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.

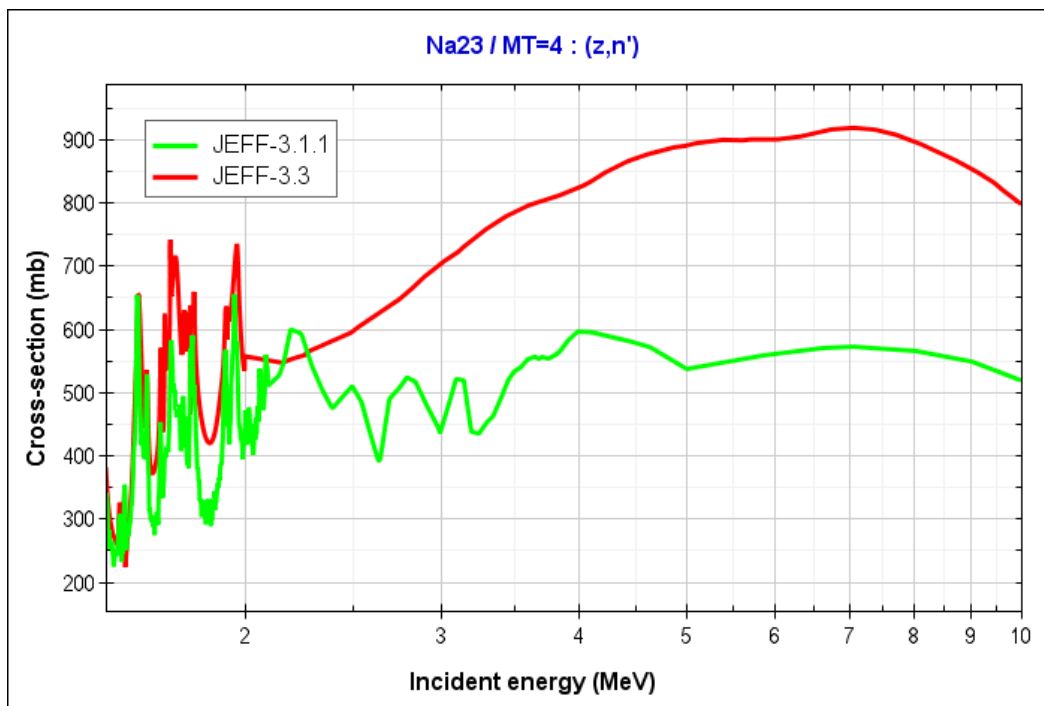


Fig. 13.1.: Figure caption.

Lidar data analysis

14.1 Elastic backscatter and inelastic retrievals

14.2 Depolarization retrieval

Let's include Table 14.1 as an example.

Tab. 14.1.: Table caption.

X1	X2	X3	X4	X5
Y1	XY1	XY2	XY3	XY4

Bandwidth filter fluorescence
retrieval

15

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

