



PhD in Information Technology and Electrical Engineering
Università degli Studi di Napoli Federico II

PhD Student: Maria Alessandra Cutolo

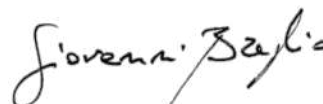
Cycle: XXXVI

Training and Research Activities Report

Academic year: 2021-22 - PhD Year: Second


student signature

Tutor: prof. G.Breglio


tutor signature

Date: October 31, 2022

Training and Research Activities Report

PhD in Information Technology and Electrical Engineering

Cycle:

Author:

1. Information:

- **PhD student:** Maria Alessandra Cutolo **PhD Cycle:** XXXVI
- **DR number:** DR995133
- **Date of birth:** 22-03-1995
- **Master Science degree:** Electronic Engineering **University:** Federico II
- **Scholarship type:** no scholarship
- **Tutor:** Prof. G.Breglio

2. Study and training activities:

Activity	Type ¹	Hours	Credits	Dates	Organizer	Certificate ²
Cyber security in Akka Technologies. Prof. D. Cotroneo, Prof. S.P. Romano, Dr. R. Natella. 04/11/2021	seminar	2	0.4	04-11-21	Prof. D. Cotroneo, Prof. S.P. Romano, Dr. R. Natella	Y
Exploring the early Universe through the cosmic microwave background. Ing. Coraggio . 04/11/2021	seminar	2	0.4	04-11-21	Ing. Coraggio	Y
IV Scuola Nazionale Biosensori Ottici e Biofotonica, Ambra Giannetti, Maria Grazia Manera, Ilaria Rea, Genni, 6/05/22 to 10/05/22	Phd School	15	4	06/05/22 To 10/05/22	Ambra Giannetti, Maria Grazia Manera, Ilaria Rea, Genni	Y
POWER-LAW GELS, SCOTT-BLAIR AND THE FRACTIONAL CALCULUS OF SOFT MULTI-SCALE MATERIALS, Gareth H. McKinley, 05/05/22	seminar	1h30m	0.3	05/05/22	Gareth H. McKinley	Y
An informal discussion around stochastic control and free boundary problems, Tiziano De Angelis, 12/05/22	seminar	1h30m	0.3	12/05/22	Tiziano De Angelis	Y
5G Networks in action – The private mobile era, Prof. Antonia Tulino, 11/05/22	seminar	2	0.4	11/05/22	Prof. Antonia Tulino	Y

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Carbon Footprint and Carbon Neutrality Prof. Antonia Tulino, 16/05/22	seminar	1h30m	0.3	16/05/22	Prof. Antonia Tulino	Y
Fixed Wireless Access, Prof. Antonia Tulino, 17/05/22	seminar	5	1	17/05/22	Prof. Antonia Tulino	Y
BASICS OF QUANTUM THEORY, Prof. Antonia Tulino, 18/05/22	seminar	2	0.4	18/05/22	Prof. Antonia Tulino	Y
Matrix Analysis for signal processing with matlab examples. Carotenuto, Aubry, De Maio.	course	-	2	-	Prof. Carotenuto, Prof. Aubry, Prof. De Maio	Y
Explainable Natural Language Inference, Prof. Francesco Cutugno, 1 hour and half. 13/04/22	seminar	1h30m	0.3	13/04/22	Prof. Francesco Cutugno	Y
Imprenditorialità Accademica, Prof. P. Rippa	course	-	4	-	Prof. P. Rippa	Y
Ci-Lam summer school, 18-07-22 to 22-07-22	Phd school	15	4	07-22 to 22-07-22	Prof. Breglio	Y
SIE Phd school, 5-09-22 to 7-09-22	Phd school	15	4	5-09-22 to 7-09-22	-	Y

- 1) Courses, Seminar, Doctoral School, Research, Tutorship
- 2) Choose: Y or N

2.1. Study and training activities - credits earned

	Courses	Seminars	Research	Tutorship	Total
Bimonth 1	0	0.8	7		7.8
Bimonth 2	0	0	8		8
Bimonth 3	2	0.3	7		9.3
Bimonth 4	4	2.7	4		10.7
Bimonth 5	0	0	10		10
Bimonth 6	12	0	9		21
Total	18	3.8	45		66.8
Expected	30 - 70	10 - 30	80 - 140	0 - 4.8	

3. Research activity:

We proposed the use of hierarchical self-assembly to obtain highly sensitive SERS-active substrates. The Numerical analysis showed that the best performances are obtained for structure with spheres radius ratios equal to 0.4. Where there is an increase in the number of hotspots and then of SERS intensity. Experimental data (implemented by raman-sers measurements, afm, sem and spectral acquisition) show well-ordered patterns only for ratio 0.20. The EF improvement (figure of merit) is consistent with numerical analysis. Considering that with the self-assembly technique used it is not possible to manufacture ordered substrates with a high value of EF,

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the possibility of using a two-phase technique was investigated. The two-step manufacturing process consists in : the layer of big spheres is done through self-assembly and then through spin coating the layer of small spheres is created. The result that arise from this new approach is that the substrate not exhibit a sufficient EF, considering the manufacturing complexity.

Research products:

Paper:

- Authors: MariaAlessandra Cutolo, GiovanniBreglio Title: Interferometric Fabry-Perot sensors for ultrasound detection on the tip of an optical fiber, Results in Optics, ISSN 2666-9501, <https://doi.org/10.1016/j.rio.2021.100209>.
- Authors: Maria Alessandra Cutolo, Carlo Cafiero, Luigi Califano, Martino Giaquinto, Andrea Cusano, Antonello Cutolo Title: Feasibility analysis of an ultrasound on line diagnostic approach for oral and bone surgery. Sci Rep 12, 905 (2022). <https://doi.org/10.1038/s41598-022-04857-0>
- Authors: Antonello Cutolo, Angelo Rosario Carotenuto, Maria Alessandra Cutolo, Arsenio Cutolo, Martino Giaquinto, Stefania Palumbo, Andrea Cusano, Massimiliano Fraldi. Title: Ultrasound waves in tumors via needle irradiation for precise medicine. Sci Rep 12, 6513 (2022). <https://doi.org/10.1038/s41598-022-10407-5>

5. Conferences and seminars attended

Confereces:

1. AIV XXV Conference Materials, Interfaces, Processes in Industrial and Basic Research Applications 2022. Hierarchical binary structures as SERS-active substrates. Authors: M. A. Cutolo, G. Quero, V. Calcagno, S. Spaziani, F. Galeotti, M. Pisco, A. Irace, G. Breglio, A. Cusano. **[Oral Presentation]**
2. ICOP Italian Conference on Optics and Photonics 2022. Hierarchical binary structures as SERS-active substrates. Authors: M. A. Cutolo, G. Quero, V. Calcagno, S. Spaziani, F. Galeotti, M. Pisco, A. Irace, G. Breglio, A. Cusano. **[Poster Presentation]**
3. SIE Riunione Annuale dell'Associazione Società Italiana di Elettronica SIE 2022 . Hierarchical binary structures as SERS-active substrates. Authors: M. A. Cutolo, G. Quero, V. Calcagno, S. Spaziani, F. Galeotti, M. Pisco, A. Irace, G. Breglio, A. Cusano. **[Poster Presentation]**

Seminars:

- Cyber security in Akka Technologies. Prof. D. Cotroneo, Prof. S.P. Romano, Dr. R. Natella. 04/11/2021
- Exploring the early Universe through the cosmic microwave background. Ing. Coraggio. 04/11/2021
- IV Scuola Nazionale Biosensori Ottici e Biofotonica, Ambra Giannetti, Maria Grazia Manera, Ilaria Rea, Genni, 6/05/22 to 10/05/22
- POWER-LAW GELS, SCOTT-BLAIR AND THE FRACTIONAL CALCULUS OF SOFT MULTI-SCALE MATERIALS, Gareth H. McKinley, 05/05/22

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- *An informal discussion around stochastic control and free boundary problems, Tiziano De Angelis, 12/05/22*
- *5G Networks in action – The private mobile era, Prof. Antonia Tulino, 11/05/22*
- *Carbon Footprint and Carbon Neutrality Prof. Antonia Tulino, 16/05/22*
- *Fixed Wireless Access, Prof. Antonia Tulino, 17/05/22*
- *BASICS OF QUANTUM THEORY, Prof. Antonia Tulino, 18/05/22*
- *Matrix Analysis for signal processing with matlab examples. Carotenuto, Aubry, De Maio.*
- *Explainable Natural Language Inference, Prof. Francesco Cutugno, 1 hour and half. 13/04/22*

6. Periods abroad and/or in international research institutions

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7. Tutorship

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8. Plan for year three

Research activities: *study, design, manufacture and testing of new substrates using the MACE manufacturing technique.*

Research periods abroad: *on planning*