



PhD in Information Technology and Electrical Engineering

Università degli Studi di Napoli Federico II

PhD Student: Roberto Tricarico

XXXII Cycle

Training and Research Activities Report – First Year

Tutor: Carlo Forestiere



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PhD in Information Technology and Electrical Engineering – XXXII Cycle

Roberto Tricarico

1. Information

- a) Roberto Tricarico, Laurea Magistrale in Ingegneria Elettronica (Master Degree in Electronic Engineering) – Università degli Studi di Napoli Federico II
- b) XXXII Cycle- ITEE – Università degli Studi di Napoli Federico II
- c) Athenaeum Fellowship
- d) Tutor: Carlo Forestiere

2. Study and Training activities

- a) Courses (credits in brackets)
 - I. Ottica Quantistica (Quantum Optics) – Master Degree in Physics (8)
 - II. Meccanica Quantistica dei Molti Corpi (Many-Body Quantum Theory) – Master Degree in Physics (8)
 - III. Teoria dei Gruppi e Applicazioni (Group Theory and Application) – Master Degree in Physics (8)
 - IV. Introduction to Quantum Electrodynamics – Ad hoc course (3)
 - V. PhD course of Antenna Synthesis, Napoli, June 19-23 (3)
- b) Seminars (credits in brackets)
 - I. Electromechanical Consequences of Violent Instabilities in Tokamaks (0.2)
 - II. Smart Nanodevices for Theranostics (0.2)
 - III. Magnetic Refrigeration: Thermodynamics of novel magnetic materials for an efficient cooling technique (0.2)
 - IV. Thermodynamics in spintronics: the spin Seebeck and spin Peltier effects (0.2)
 - V. "XLII Scuola estiva di Fisica Matematica" - National Group of Mathematical Physics, Ravello, September 4-16 (6)
 - VI. PhD school "Ferdinando Gasparini", Napoli, October 23-27 (3)

3. Credits Summary

	Credits year 1								Credits year 2								Credits year 3								Total	Check
	Estimated	1	2	3	4	5	6	Summary	Estimated	1	2	3	4	5	6	Summary	Estimated	1	2	3	4	5	6	Summary		
Modules	30	8	3	11	0	0	8	30	20							0	0							0	30	30-70
Seminars	10	0.4	0	0.4	6	3	0	9	10							0	0							0	9	10-30
Research	20	3	5	3	3	6	1	21	30							0	60							0	21	80-140
	60	11	8	14	9	9	9	60	60	0	0	0	0	0	0	0	60	0	0	0	0	0	0	0	60	180

4. Research activity

- a) Title
Classical and Quantum Electromagnetic Theory of Nanoparticles
- b) Study
Classical and Quantum Plasmonics
- c) Research description

I'm involved in all the activities of the research group. In general, we study the electromagnetic scattering by plasmonic nanoparticles. On the one hand, we continue to develop the Material-Independent Modes decomposition introduced last year, as a clever way to face the problem of scattering from Nanoparticles. On the other hand, we try to establish connections with other different fields of study, in order to investigate the existence of new interaction phenomena. In particular, we are studying the coupling between plasmons and Josephson junctions. We also have a research line on the computational aspects of Bohmian Quantum Mechanics in the study of

ordinary electronic devices. Anyway, my personal main interest is in the quantum electrodynamic analysis of standard plasmonic structures, having the goal to understand how this modern vision can give relevant corrections to the classical *electromagnetic scattering theory*, considering that, nowadays, the structures are becoming smaller and smaller.

d) Collaborations

We collaborate with the Electrical Engineering group from the University of Cassino (Prof. Tamburrino), but we also collaborate with groups from physics for what concerns the superconducting line (Profs. Tagliacozzo, Pepe, Tafuri) and with Prof. Figari (physics) and Prof. Coppola (space engineering - fluid dynamics) for what concerns *Bohmian Mechanics*.

5. Products

a) Publications under review

- i. C. Forestiere, G. Miano, M. Pascale, R. Tricarico, chapter title: "A full-retarded spectral technique for the Fano-resonance analysis in a dielectric nanosphere", *Springer book: "Fano Resonances in Optics and Microwaves"*
- ii. C. Forestiere, G. Miano, G. Rubinacci, A. Tamburrino, R. Tricarico, S. Ventre, "Material-Independent Modes of Arbitrarily Shaped Homogeneous Scatterers", *IEEE Transactions on Antennas and Propagation*

6. Conferences

a) Details

- i. *Plasmonica2017, Lecce, July 5-7, Best Oral Presentation (500 EUR)*
- ii. *EOS topical meeting at Capri, Anacapri, September 12*

b) Presentation made

- i. *Material-Independent Modes for Electromagnetic Scattering from Nanoparticles, Lecce*
- ii. *Material-Independent Modes for Electromagnetic Scattering from Nanoparticles, Anacapri*

Roberto Tricarico



Carlo Forestiere

