Riccardo De Gennaro

Curriculum Vitae

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Education

2014–2017 **Master's degree**, *University of Rome Tor Vergata*, Rome, Italy.

Physics (curriculum: Structure of Matter), 110/110 Cum Laude.

GPA: 29.5/30 (12 exams, 5 with honors)

Master thesis

Electron-phonon coupling from Projected Atomic Orbitals Hamiltonians

Advisors: Marco Buongiorno Nardelli, Maurizia Palummo.

Description: PAOFLOW is a set of modules, developed by Marco Buongiorno Nardelli's group, able to operate on Hamiltonians calculated from density-functional theory and then projected on basis of atomic orbitals. I am extending the capabilities of PAOFLOW to calculate also the electron-phonon coupling parameters using these projected Hamiltonians, within the frozen-phonon approximation [1].

2010–2014 **Bachelor's degree**, *University of Rome Tor Vergata*, Rome, Italy.

Physics, 110/110 Cum Laude.

GPA: 28.2/30 (20 exams, 4 with honors)

Bachelor thesis

Fabrication of solution-processed OLEDs

Advisors: Paolo Prosposito, Roberto Pizzoferrato.

Description: I have produced several solution-processed organic LEDs. Later I have characterized optically and electrically the devices. Finally some peculiar molecules have been used as dyes to tune the emission wavelength from the active layer.

Experiences

Mar 2016–Apr 2016 **Stage UNT** | I conducted my work in collaboration with ERMES group at University of North Texas, under the supervision of professor Marco Buongiorno Nardelli. Marco Buongiorno Nardelli *et al.* have developed a new pseudo-hybrid Hubbard density-functional, called ACBN0, and they discussed its application to several transition metal oxides (MnO, CoO, NiO and FeO) [2]. In my work, I studied the paramagnetic-antiferromagnetic transition of these metal oxides, using a first-principle approach. I represented all the systems using a 3D Heisenberg model, including first and second nearest neighbors interactions. For the two exchange integrals, I used the values calculated by ACBN0. Through a Monte Carlo simulation, I analyzed the the magnetic phase transition of each metal oxide, in order to calculate the correspondent Néel temperature. The code to make these calculations has been written in C.

Jan 2016 **Calibration of α and γ particles detectors** | We have measured the spectra of α and γ particles emitted from several radioactive sources, using two different types of solid state detectors. The results have been used to calibrate the two detectors and later to obtain the efficiency and the energetic resolution. The measurements have been carried out at ENEA in Frascati, Italy.

Nov 2015 **AFM on Red Blood Cells** We have used the powerful tools of Atomic Force Microscopy to study the surfaces of cells from different specimens. The main goal was to examine the surface of the cells in order to correlate the shape and the roughness with the degradation process. The measurements have been carried out at the CNR in Frascati, Italy.

May 2015 **Electrochemical STM on graphite** | We have used Scanning Tunneling Microscope to investigate in situ the surface of graphite immersed in a liquid. The atomic scale has been reached showing the typical honeycomb structure and also some peculiar Moiré patterns.

Apr 2015 **AFM and MBE** | We have analyzed the growth of InAs quantum dots on GaAs substrate using AFM technology. The epitaxial growth has been performed through MBE process and we progressively controlled the growth using in situ RHEED technique. The experience has been supervised by Fabrizio Arciprete, Ernesto Placidi and Klaus Wandelt.

Jun 2014 **Stage Tor Vergata** | Under the supervision of the professors Paolo Prosposito and Roberto Pizzoferrato I have continued the work of my bachelor thesis. I have characterized the optical properties of some new polymers. Then I have tried the efficiency of these molecules used as dyes within the emissive layer of some OLEDs. The work has been carried out at the NEMO lab and at the optical properties laboratory of the industrial engineering department of Tor Vergata.

Languages

Mother tongue Italian

Other languages English and French

Computer skills

Languages Python, C, Fortran95, LaTeX

Scientific Software QUANTUM ESPRESSO, AFLOWπ, PAOFLOW, OriginPro

Publications

[1] M. Buongiorno Nardelli, F. T. Cerasoli, M. Costa, S. Curtarolo, R. De Gennaro, M. Fornari, L. Liyanage, A. R. Supka, and H. Wang, *PAOFLOW: A utility to construct and operate on ab initio Hamiltonians from the Projections of electronic wavefunctions on Atomic Orbital bases (PAO), including characterization of topological materials*, Comput. Mater. Sci. **143** (2018).

[2] P. Gopal, R. De Gennaro, M. S. Gusmao, R. Al Rahal Al Orabi, H. Wang, S. Curtarolo, M. Fornari, and M. Buongiorno Nardelli, *Improved electronic structure and magnetic exchange interactions in transition metal oxides*, J. Phys. Condens. Matter **29**, 444003 (2017).