europass

Riccardo Piombo

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ABOUT ME

I am a condensed matter physicist proficient in several programming languages and expert in numerical simulation of strongly correlated system, and phase change memories.

WORK EXPERIENCE

Rome, Italy
POST DOCTORAL RESEARCHER CREF

Development of optimal transport methods in economic complexity from maximum entropy probability distributions.

Rome, Italy
POST DOCTORAL RESEARCHER UNIVERSITÀ DI ROMA - LA SAPIENZA

Neuromorphic computing - Ab-Initio and classical molecular dynamics simulations of chalcogenide heterostructures using neural network interatomic potentials.

EDUCATION AND TRAINING

Rome, Italy
PHD IN PHYSICS Università di Roma - La Sapeinza

I focused on the chemistry of silver fluoride (AgF2) as a potential analog to cuprates, materials exhibiting high-temperature superconductivity. I modelized several AgF2 experimental data, including valence band photoemission and Meitner-Auger spectroscopy. I strongly relied on DFT and exact diagonalization computations to estimate AgF2 Coulomb interaction and its charge-transfer energy. My investigations revealed that AgF2 is a charge-transfer correlated insulator within the Zaanen-Sawatzky-Allen scheme. Moreover, AgF2 possesses a more covalent nature compared to cuprates despite sharing similarities in electronic excitations: we provided detailed insights into AgF2 charge-transfer gap, d-d excitations and a potential proximity to a charge-transfer instability. Finally, I explored with exact diagonalization techniques the spin spectra of several cuprates: La2CuO4, Sr2CuO2Cl2 and CaCuO2.

Final grade Excellent | **Thesis** Correlation and Cuprate-like Physics in Silver Fluorides

Rome, Italy
M.SC. IN THEORETICAL PHYSICS Università di Roma - La Sapeinza

I studied a simplified model of AgF or the parent compound of this hypothetical new class of high-T_c superconductors: one-dimensional linear chains formed by Ag and F sites with strong inter-site and on-site Coulomb interactions. Here, I only considered the charge degrees of freedom to study the valence instability of the compound. The hypothesis was the following: when holes localized on the silver ions tend to move collectively on the fluorine ions, excitonic soft modes appear during the phase transition. I analyzed the phase diagram and the dynamical charge structure factor of the system using a Quantum Lattice Model Simulator and Green's function theory to determine the characteristics of the transitions close to the valence instability.

Final grade 109/110 | **Thesis** Valence instabilities and electronic soft modes

PUBLICATIONS

2024
Ab Initio Study of Novel Phase-Change Heterostructures

Advanced Science, 2402375

2022
Strength of Correlations in a Silver-based Cuprate Analogue

Phys. Rev. B, 106, 035142

2022
Multiple-Magnon Excitations Shape the Spin Spectrum of Cuprate Parent Compounds

Phys. Rev. B 103, L140409

2022
Charge Transfer and d − d Excitations in AgF2

Phys. Rev. Research 4, 023108

HONOURS AND AWARDS

Contributi Premiali regione lazio – Regione lazio

Selected researchers received a €2000 grant to encourage more and higher-quality scientific publications, awarded after a thorough peer-review of their work.

Avvio alla Ricerca Tipo II Starting Grant

NANO PCM - New Advanced NeurOmorphic Phase-Change Materials
Project AR2221816834DCFB funded with €4000.

Various HPC projects

More than 160000 cpu/hours in CINECA ISCRA projects (1 KNL CPU hour ≈ € 0.10)

CONFERENCES AND SEMINARS

Rome
EPCOS

Contributed talk: Structural and Dynamical Properties of the Liquid Phase of New Phase-Change Heterostructures

LANGUAGE SKILLS

Mother tongue(s): **ITALIAN**

Other language(s):

	UNDERSTANDING		SPEAKING		WRITING
	Listening	Reading	Spoken production	Spoken interaction	
ENGLISH	C1	C2	C1	C1	C1

Levels: A1 and A2: Basic user; B1 and B2: Independent user; C1 and C2: Proficient user

"Autorizzo il trattamento dei miei dati personali ai sensi del Decreto Legislativo 196/2003, coordinato con il Decreto Legislativo 101/2018, e dell'art. 13 del GDPR (Regolamento UE 2016/679) ai fini della pubblicazione in Amministrazione Trasparente - Sapienza come da normativa vigente."