Curriculum vitæ
SIMONE PELI

Personal Data

Name and Surname: Simone Peli

Present Citizenship: Italian

Date of Birth: 17th of march, 1986

Address: via San Giovanni, 16 - 25060 Polaveno (BS), Italy

Phone: +39 030 8940902

Mobile: +39 339 1683207

Email: pelisimone@gmail.com

Experience

July 2017 - present day Visiting Faculty in the Department of Physics at the Indian Institute of Technology - Kharagpur - India

Project: *"Development of an all-optical system for ultrafast time-resolved experiments at the nanoscale."* collaborative work with Prof. Prasanta Kumar Datta.

My expertise in developing experimental setup for time-resolved measurements has been requested by the IIT Kharagpur with the final target of building, from scratch, a microscopic system for studying the different dynamical processes in nanostructured materials. With such a system we can address the main

open questions regarding optical and mechanical properties of a broad family of nanomaterials (nanodots, nanowires, thin films etc.). This system has been recently updated to observe also spin dynamics of magnetic materials through time resolved-MagnetoOptical Kerr Effect (tr-MOKE) measurements. Beside this main topic, I gave my contribution in the optimization (signal-to-noise level and data acquisition software) of the already present THz spectroscopy system and Transient Absorption Spectroscopy setup.

March 2015 - April 2017 Postdoctoral Fellowship at the Catholic University in Brescia

Project: *"Ultrafast thermodynamics at the nanoscale"* under the supervision of Dr. Francesco Banfi.

In my postdoctoral research activity I exploited my expertise in the field of the ultrafast pump-probe spectroscopy to study the physics at the nanoscale. In order to do that I have developed high-sensitive and high-stable spectroscopic systems for the analysis of the thermo-mechanical physics of nanostructured materials like patterned nanodots, patterned nanowires, thin films and single nanoparticles. In particular I turned my attention to nanotechnology, developing dedicated characterization tools to inspect mechanical properties of nanogranular materials.

Education

2011- January 2015 Ph.D. degree in Physics at the State University of Milan (XXVII cycle), Italy

Project: *"Unfolding the ultrafast interplay between delocalized wavefunctions and localized electronic interactions in quantum correlated materials"* under the supervision of Dr. Claudio Giannetti.

My Ph.D. research activity was focused at the understanding of the ultrafast electron dynamics in superconducting copper oxides. These are quantum materials

that exibit exotic properties like colossal magnetoresistance and High-Tc superconductivity and whose microscopic behavior is not already completely clear. I learnt how to manage a complex pump-probe setup experiment that allows to have informations about the relaxation dynamics of a broad class of materials on the femtosecond scale and over a broad frequency range. I contributed to the realization and the use of the time-resolved spectroscopy setup located in the laboratories of Universitá Cattolica in Brescia based on a Ti:Sapphire laser and a photonic crystal fiber for the generation of supercontinuum light. I have also learnt to use the time-resolved spectroscopy setup, located at the Politecnico of Milan, based on an optical parametric amplificator allowing a finer time resolution.

During the second year of my Ph.D. I spent 11 months at the ARPES laboratories at the University of British Columbia (UBC), Vancouver. At UBC I built, from scratch, the ultrafast optical set-up for time-resolved measurement to be coupled to the already present ARPES apparatus in order to achieve time-resolved ARPES capabilities. I have also given my contribution in performing measurements with the XUV-ARPES setup located in the ARTEMIS lab at the Central Laser Facilities in Harwell Oxford. I applied these techniques to investigate in particular the single layer copper oxide La-Bi2201 where I have found a discontinuity with the doping in the behaviour of the charge-transfer excitation at 2.1 eV at room temperature. Thanks to the XUV-ARPES measurements on double-layer copper oxide Y-Bi2212 I have studied the dynamics of the oxygen band at 2.5 eV binding energy and its relation with the superconductivity in this compound. With time-resolved optical spectroscopy I have studied the dynamics of the optical properties in sodium iridate Na2IrO3 in wich the electronic correlation and the strong spin-orbit coupling compete on the same energy scale.

2009-April 2011 Master degree in Physics at the Catholic University in Brescia (110/110 e lode)

Thesis: *"Development of an asynchronous optical sampling laser system for time-resolved spectroscopy measurements by evanescent*

wave" under the supervision of Prof. G. Ferrini.

In the period of my master degree I consolidated my knowledge of optical spectroscopy develpoing a pump-probe experiment based on the physical phenomenum of the evanescent wave. This experiment was performed using an asynchronous optical sampling (ASOPS) technique. Generating an evanescent infrared wave on the surface of a glass prism, I could track the relaxation dynamics (on the femtosecond scale) of a thin film of gold deposited on the surface of the prism after an excitation with a laser pulse. This technique, thanks to its high sensitivity and the very low intrusiveness, it's very useful to study the response of biological samples to an external perturbation and a unique tool to investigate the making and the breaking of the chemical bonds on their actual femtosecond timescale.

2005-January 2009 Bachelor degree in Physics at the Catholic University in Brescia (107/110)

Thesis: *"Second Harmonic Generation in KNaNS ceramic glasses with short laser pulses"* under the supervision of Prof. G.Ferrini.

During my bachelor degree I had the opportunity to approach the world of the laser optical spectroscopy and the non-linear optics. In my thesis work I used non-linear crystals to double the frequency of the fundamental laser light to obtain the so-called Second Harmonic. I compared the efficiency of the conventional non-linear crystals (BBO) with novel promising materials (inhomogeneous ceramic glasses).

2000-June 2005 High School at Liceo Scientifico F. Moretti in Gardone Val Trompia (Bs) (95/100).

International Experience

April 2013 - March 2014 Research activity at the ARPES lab at the University of British Columbia (Vancouver) in the research group of Prof. Andrea Damascelli. During this period I learned how to manage a photoemission (ARPES) experiment and a Ultra-High Vacuum chamber. I used my experties in optical spectroscopy to setup a time-resolved photoemission experiment installing an optical system with a laser oscillator. I generated 6 eV light using BBO non linear crystals in order to obtain the photon energy required from a photoemission experiment. I performed laser photoemission to test the energy resolution of the system and I started a pump-probe experiment that will allow to follow the dynamics of the electronic structure of quantum materials in general.

November 2014 I have participated to the experiments performed at the XUV time-resolved photoemission beamline ARTEMIS at the Central Laser Facilities (Rutherford-Appleton Laboratories) in UK. With this technique it is possible to generate high harmonics using a laser pulse in a gas jet and use such harmonics (10- 100 eV) to do a photoemission experiment. I have gained the expertise in generating high-harmonics from a fundamental Ti:Sapphire laser and in performing photoemission with such photon energies.

Experimental Skills

Time-resolved photoemission spectroscopy: Ultra-High-Vacuum techniques, in-situ sample preparation and characterization, photoelectrons detection. Realization of the optical part for generating 6

eV photons. Use of the XUV-ARPES setup.

Non-Linear Optics: Maintenance of a femtosecond laser source, High Harmonics generations, development of pulse characterization techniques. Generation of supercontinuum light from photonic crystal fiber.

Time-resolved optical spectroscopy: Development of a pump-probe set-up with mechanical delay stage and asyncronous optical sampling (ASOPS), multiple lock-in detection. Use of an OPA-based spectroscopy system. THz generation by means of THz antennas and ZnTe crystals. Use of microscope objective for imaging and spatially resolved optical measurements.

Publications

Collapse of superconductivity in cuprates via ultrafast quenching of phase coherence
F. Boschini, E. H. da Silva Neto, E. Razzoli, M. Zonno, S. Peli, R. P. Day, M. Michiardi, M. Schneider, B. Zwartsenberg, P. Nigge, R. D. Zhong, J. Schneeloch, G. D. Gu, S. Zhdanovich, A. K. Mills, G. Levy, D. J. Jones, C. Giannetti and A. Damascelli. *Nature Materials* (2018)

Dynamics of correlation-frozen antinodal quasiparticles in superconducting cuprates
Federico Cilento, Giulia Manzoni, Andrea Sterzi, Simone Peli, Andrea Ronchi, Alberto Crepaldi, Fabio Boschini, Cephise Cacho, Richard Chapman, Emma Springate, Hiroshi Eisaki, Martin Greven, Mona Berciu, Alexander F. Kemper, Andrea Damascelli, Massimo

Capone, Claudio Giannetti and Fulvio Parmigiani. *Science Advances*, **4** (2018)

Mottness at finite doping and charge instabilities in cuprates
S. Peli, S. Dal Conte, R. Comin, N. Nembrini, A. Ronchi, P. Abrami, F. Banfi, G. Ferrini, D. Brida, S. Lupi, M. Fabrizio, A. Damascelli, M. Capone, G. Cerullo and C. Giannetti. *Nature Physics*, **13** 806-811 (2017)

Tracking local magnetic dynamics via high-energy charge excitations in a relativistic Mott insulator
N. Nembrini, S. Peli, F. Banfi, G. Ferrini, Yogesh Singh, P. Gegenwart, R. Comin, K. Foyevtsova, A. Damascelli, A. Avella, and C. Giannetti. *Phys. Rev. B*, **94** (2016)

Mechanical Properties of Ag Nanoparticle Thin Films Synthesized by Supersonic Cluster Beam Deposition
Simone Peli, Emanuele Cavaliere, Giulio Benetti, Marco Gandolfi, Mirco Chiodi, Claudia Cancellieri, Claudio Giannetti, Gabriele Ferrini, Luca Gavioli and Francesco Banfi. *J. Phys. Chem. C*, **120** (2016)

Discrimination of molecular thin films by surface-sensitive time-resolved optical spectroscopy
Simone Peli, Nicola Nembrini, Francesco Damin, Marcella Chiari, Claudio Giannetti, Francesco Banfi and Gabriele Ferrini. *Applied Physics Letters*, **107** (2015)

Snapshots of the retarded interaction of charge carriers with ultrafast fluctuations in cuprates
S. Dal Conte, L. Vidmar, D. Golez, M. Mierzejewski, G. Soavi, S. Peli, F. Banfi, G. Ferrini, R. Comin, B. Ludbrook, L. Chauviere, N. Zhigadlo, H. Eisaki, M. Greven, S. Lupi, A. Damascelli, D. Brida,

M. Capone, J. Bonca, G. Cerullo and C. Giannetti. *Nature Physics*, **11** (2015).

Photo-enhanced antinodal conductivity in the pseudogap state of high-Tc cuprates
F. Cilento, S. Dal Conte, G. Coslovich, S. Peli, N. Nembrini, S. Mor, F. Banfi, G. Ferrini, H. Eisaki, M.K. Chan, C. Dorow, M. Veit, M. Greven, D. van der Marel, R. Comin, A. Damascelli, L. Rettig, U. Bovensiepen, M. Capone, C. Giannetti, F. Parmigiani. *Nature Communications*, **5** (2014).

Crystallization and second harmonic generation in potassium-sodium niobiosilicate glasses
Antonio Aronne, Esther Fanelli, Pasquale Pernice, Simone Peli, Claudio Giannetti, Gabriele Ferrini. *J. Solid State Chem.*, **182** 2796 (2009).

Languages

Italian Mother tongue

English Good knowledge of English.

IT Skills

Windows operating system and Mac OS X, Microsoft Office, Latex typesetting language, Wolfram Mathematica, LabView National Instruments, and very good knowledge of data analysis software Igor Pro.

Kharagpur, India, April 2018