STEFANO LUPI
Curriculum Vitae

Part I – General Information

Full Name	Stefano Lupi
Date of Birth	02/12/1963
Place of Birth	Rome
Citizenship	Italian
Permanent Address	Rome, Via Vincenzo Rovero 2, 00135
Mobile Phone Number	+393332537579
E-mail	stefano.lupi@uniroma1.it
website	https://sites.google.com/uniroma1.it/sapienza-terahertz/home
Spoken Languages	Italian (mother language), English (fluent), French (fluent)

Part II – Education

Type	Year	Institution	Notes (Degree, Experience,…)
University graduation	1989	Sapienza University of Rome	110/110 cum laude, Laurea Thesis: "Infrared Spectroscopy on the CD_4 Molecular Quantum Solid”;
Post-graduate studies	1989	Sapienza University of Rome	Six months post-graduate fellowship of GNSM-CNR for spectroscopic studies on molecular solids;
PhD in Physics	1990-1992	Sapienza University of Rome	PhD fellowship on " An Infrared Study of High-Tc Superconductors in their Normal Phase”, at the Department of Physics, Sapienza University of Rome;
Post-Doc fellowship in the EU research program "Human Capital and Mobility"	1993-1995	LURE laboratory of the University of Paris-Sud, France;	Infrared Synchrotron radiation investigation of High-Tc Superconductors;
Post-Doc fellowship	January 1996-June 1996	LURE laboratory of the University of Paris-sud, France;	Infrared Synchrotron radiation investigation on strongly correlated electronic systems;

Part III – Appointments

IIIA – Academic Appointments

Start	End	Institution	Position
1996	2004	Department of Physics, Sapienza University of Rome;	Permanent Researcher
2005	Now	Department of Physics, Sapienza University of Rome;	Permanent Associate Professor
2013	2024		National Scientific Qualification to Full Professor in Experimental Physics of Matter, 02/B1
			ABILITAZIONI 2012, 2016

IIIB – Other Appointments

Start	End	Institution	Position
2015	2017	MEPHI University Moscow;	Associate Professor
February 2016	October 2016	Department of Physics, University Statale Milano;	Visiting Professor
June 2010	October 2010	Max Planck CFEL Laboratory, Hamburg University, Germany;	Visiting Professor
November 2009	March 2010	Elettra Sincrotrone Trieste	Visiting Professor
October 2001	March 2002	University of Paris-sud, Paris, France;	Visiting Professor

Part IV Scientific Responsabilities

1. Responsible of the international project "3-Dimensional Graphene: Applications in Catalysis, Photoacoustics and Plasmonics" of MAECI Italy-China scientific cooperation program (2019-2021);

2. Responsible of the international project "Linear, non-linear, and time-resolved Terahertz spectroscopy using the latest radiation sources" of MAECI Italy-Japan scientific cooperation program (2017-2019);

3. Responsible of the international project "Valutazione dell'effetto immunogenico di nanoparticelle superparamagnetiche (YFe2O3@Ag) come piattaforma per lo sviluppo e il controllo di adiuvanti nei vaccini" of CNR-NRC Italy-Egypt scientific cooperation program (2018-2020);

4. Responsible of SapienzaTerahertz Laboratory (Frequency and Time Domain Terahertz Spectroscopy) at the Department of Physics, Sapienza University of Rome, Italy: https://sites.google.com/uniroma1.it/sapienza-terahertz/home;

5. Responsibile of WP13-Task2 "3D Graphene" of international project Graphene Flagship Core 2 (2018-2020);

6. Responsible of the "Material Science" branch line (CNR-IOM) of the SISSI infrared and terahertz beamline at the Elettra Synchrotron, Trieste, Italy;

7. Responsible of the SL_FEMTOTERA terahertz bemline at the SPARC_LAB LNF-INFN, Frascati, Italy;

8. Co-Responsible of the TERAFERMI terahertz beamline at FERMI@Elettra free electron laser, Trieste, Italy;

Part V –A Teaching experience at Sapienza

Year	Institution	Lecture/Course
Since 2005	Department of Physics, Sapienza University of Rome;	Spectroscopic and Nanophotonics Methods for Condensed Matter Physics;
Since 2016	Department of Scienze della Terra, Sapienza University of Rome;	Mechanics and Thermodynamics, Laurea Triennale;
Since 2010	PhD Lectures at Department of Physics, Sapienza University of Rome;	Spectroscopy on exotic electronic materials;
2011-2015	Department of Physics, Sapienza University of Rome;	Struttura della Materia, Laurea Triennale;
2008-2011	Department of Physics, Sapienza University of Rome;	Ottica e Laboratorio, Laurea Triennale;
2004-2008	Department of Physics, Sapienza University of Rome;	Laboratorio di Meccanica, Laurea Triennale;
1999-2000	Department of Physics, Sapienza University of Rome;	Esperimentazione Fisica I, Laurea quadriennale

Part V –B Abroad teaching experiences

Since 2007	Lectures in the International School of Synchrotron Radiation, Duino, Trieste, Italy;	Infrared Synchrotron Radiation: From the production to the use;
Since 2015	Lectures at MEPHI University, Moscow, Russia;	Infrared and Terahertz Spectroscopy on Strongly Correlated Electron Systems;
2000-2008	Lectures for the PhD in Physics, in the Department of Physics, Salerno University	Infrared and Terahertz Spectroscopy on Strongly Correlated Electron Systems;

Part VI – Student Tutoring

Post-Doc Students

1. Salvatore Macis: Physics Department, Sapienza University;

2. Benjamin Briere: CNR-IOM Beamline SISSI@Elettra;

3. Federica Piccirilli: CNR-IOM Beamline SISSI@Elettra;

4. Sen Mou: TERA INFN;
5. Annalisa D'Arco: TERA INFN;
6. Francesco De Nicola: Graphene Flagship;
7. Flavio Giorgianni: INFN-Sezione Roma1;
8. Odeta Limaj: Physics Department, Sapienza University;
9. Andrea Perucchi: CNR-IOM Beamline SISSI@Elettra;

PhD Students

1. Luca Tomarchio, Thesis: "Linear and non linear Terahertz Spectrscopy on Topological Materials";
2. Marte Autore, Thesis: "Terahertz and infrared study of Topological Insulators";
3. Fausto D'Apuzzo, Thesis: "Materials for infrared and terahertz plasmonics";
4. Maddalena Daniele, Thesis: "Infrared, Dynamic light scattering and rheology of biocompatible gels";
5. Flavio Giorgianni, Thesis: "Developments of advanced Terahertz sources for nonlinear and time-resolved terahertz spectroscopy";
6. Odeta Limaj, Thesis: "Investigation of terahertz and mid-infrared metamaterials";
7. Irene Lo Vecchio, Thesis: "Metal to insulator transitions in strongly correlated oxides investigated by infrared and angle resolved photoemission spectroscopy";
8. Gihan Khamel, Thesis: "Investigation of structure-function relationship of biomolecules, using infrared spectroscopy, thermodynamics, Brewster angle microscopy analysis";
9. Leonetta Baldassarre, Thesis: "Optical properties of vanadium oxides";
10. Paola Di Pietro, Thesis: "Optical properties of Bismuth-based Topological Insulators";
11. Daniele Nicoletti, Thesis: "An infrared study of metallic-phase instabilities driven by temperature and doping in superconducting cuprates";
12. Chiara Mirri, Thesis: "Exotic superconductors: an infrared spectroscopy study";
13. Matteo Valentini, Thesis: "Infrared and Raman spectroscopy of cobaltites";

Graduate Students (Laurea Thesis)

1. Eleonora Bonaventura, Thesis: "Optical Properties of stanene";

2. Marta Di Fabrizio, Thesis: “Biomedical Imaging by Terahertz Spectroscopy”;

3. Luca Tomarchio, Thesis: “Terahertz and Optical Properties of Weyl Materials”;

4. Fausto D'Apuzzo, Thesis: “Mid-infrared biosensing based on plasmonic devices”;

5. Stefania De Rosa, Thesis: “Optical spectra of silicene”;

6. Valeria Giliberti, Thesis: “Risposta elettromagnetica dai terahertz all’infrarosso di metamateriali innovativi”;

7. Flavio Giorgianni, Thesis: “Metamateriali superconduttori”;

8. Yan Huanyu, Thesis: “An apparatous for optical pump-terahertz probe spectroscopy”;

9. Irene Lo Vecchio, Thesis: “NMR and photoemission study of the electronic phase coexistence in V_2O_3 Mott-Hubbard insulator”;

10. Andrea Marchese, Thesis: “Optical and terahertz properties of Dirac materials”;

11. Mattia Rattà, Thesis: “Manipolazione della superconduttività nel FeSeTe con campi terahertz intensi”;

12. Andrea Rovere, Thesis: “Spettroscopia non lineare su Isolanti Topologici”;

13. Alba Piacenti, Thesis: “Plasmonic excitations in nanoporous graphene”;

14. Roberto Provenzano, Thesis: “infrared spectroscopy of microporous graphene”;

15. Giorgia Sparasassi, Thesis: “Study of the insulator to metal transition in thin film
s and single crystals of vanadium dioxide”;

16. Andrea Starace, Thesis: “Dispositivi plasmonici infrarossi con metalli convenzionali e non: il caso dell’Au e dell’ITO”;

17. Lorenzo Tenuzzo, Thesis: “Photoacoustic based graphene”;

18. Marta Autore Thesis: “Infrared spectroscopy of charge-ordered cuprates”;

19. Leonetta Baldassarre, Thesis: “Effetti dell’ordinamento di carica nella conducibilità infrarossa del cobaltato di sodio Na_xCoO_2”;

20. Elisa Borfecchia, Thesis: “Spettroscopia Infrarossa di catene artificiali di DNA”;

21. Paola Di Pietro, Thesis: “Proprietà ottiche del cuprato superconduttore $Sr_{2-x}CuO_2Cl_2$ nel limite di lacune diluite”;

22. Odeta Limaj, Thesis: “Proprietà ottiche del superconduttore ad alta temperatura di transizione $Bi_2Sr_{2\ x}La_xCuO_6$”;

23. Daniele Nicoletti (Calvani, Lupi), Thesis: “Studio della transizione metallo-isolante negli ossidi di vanadio V_3O_5 e V_2O_3 mediante spettroscopia infrarossa”;

24. Francesco Vitucci, Thesis: “Transizioni isolante-metallo indotte dalla temperatura e dalla pressione in manganiti doppie”;

Undergraduate Students (Dissertazione Thesis)

1. Andrea Altamura, Dissertazione Thesis: “Produzione e uso della radiazione terahertz”;

2. Marco Campetella, Dissertazione Thesis: “Ottica con materiali ad indice di rifrazione negativo”;

3. Matteo Chiaverini, Dissertazione Thesis: “Proprietà infrarosse del diossido di vanadio”;

4. Fausto D'Apuzzo, Dissertazione Thesis: “Proprietà infrarosse di materiali plasmonici”;

5. Flavia D'Arpino, Dissertazione Thesis: “Materiali con indice di rifrazione negativo”;

6. Odeta Limaj, Dissertazione Thesis: “Ottica dei metamateriali”;

7. Irene Lo Vecchio, Dissertazione Thesis: “Ottica con metamateriali plasmonici”;

8. Daniele Nicoletti, Dissertazione Thesis: “Lo spettro infrarosso del cobaltato di sodio Na_xCoO_2”;

9. Gianluca Musarra, Dissertazione Thesis: “Al di là del limite di diffrazione”;

10. Andrea Petrella, Dissertazione Thesis: “L’effetto Fano”;

11. Mattia Rattà, Dissertazione Thesis: “Spettri di assorbimento IR di acidi verdi”;

12. Paolo Rissone, Dissertazione Thesis: “La fase di Berry”;

13. Nicola Parente, Dissertazione Thesis: “Aspetti di risonanza Fano in sistemi interagenti”;

14. Paolo Sciortino, Dissertazione Thesis: “Fisica dei metamateriali ottici”;

15. Laura Schade, Dissertazione Thesis: “La fase di Berry”;

16. Daniele Vannicola, Dissertazione Thesis: “Teoria ed esperimenti sull’indice di rifrazione negativo”;

17. Nicola Zilli, Dissertazione Thesis: “Proprietà infrarosse di materiali plasmonici”;

Part VII Scientific Management Responsabilities and scientific associations

1. Member of committee ConScienze Price (2020);

2. Member of exam commission for a technologist position INFN (2020);

3. Member of doctoral commitee “Fisica degli Acceleratori” (2018-Now);

4. President of the exam commission for a position of administrative assistant INFN (2019);

5. Member of the PhD final-examination committee in Scienze della Terra, curriculum “Cultural Heritage”, Sapienza University (2017);

6. Member of doctoral commitee “Modelli Matematici per l'Ingegneria, Elettromagnetismo e Nanoscienze” (2010-Now);

7. INFN Scientific association (2010-Now);

8. CNR-IOM Scientific association (2002-Now);

9. Elettra Sincrotrone Trieste association (2002-Now);

10. RUP (Responsabile Unico Procedura) of several adiministrative tenders for INFN and Elettra;

11. Responsible of the didactic laboratory of the Department of Physics B. Pontecorvo (2006-2011);

12. Member department committee “Borse Perfezionamento Estero” (2012-2015);

13. Member department committee “Studio-Lavoro” (2010-2013);

Part VIII-Reviewer Activity

1. MIUR Reprise projects, Italy;

2. Gordon and Betty Moore Foundation projects, USA;

3. National Science Centre projects, Poland;

4. German Research Foundation projects, Germany;

5. Reviewer of Nature, Nature Communications, Nature Physics, Phys. Rev. Letters, Phys. Rev. B, ACS Nanoletters, ACS Nano;

Part IX - Society memberberships, Awards and Honors

Year	Title
Since 2019	Member of the Scientific Committee of the IRMMW (Intenational Conference on Infrared, Millimeter and Terahertz Waves) Conference;
Since 2018	Member of the Scientific Committee of the LEES (Low-Energy Electrodynamics of Solids) Conference;
Since	Member of the Scientific Committee of the WIRMS (Infrared Microscopy and

2011	Spectroscopy with Accelerator Based Sources) Conference;
Since 2012	Member of the Scientific Committee of the SuperFox (Superconductivity and Functional Oxides) Conference;
2014-2017	Member of Proposal Committee "Matter & material properties: Structure, Organisation Characterisation, Elaboration" of Soleil Synchrotron;
2008-2010	Member of Council Committee of the CNR/INFM-COHERENTIA Research Institute

Part X – Organized Conferences

2019	**Chair** of the Terahertz Sapienza Workshop, December, 10-11, 2019, Rome, Italy;
2019	**Chair** of Terahertz Radiation Session, PIERS International Conference, June, 17-19, 2019, Rome, Italy;
2018	**Co-Chair** of the 3D-Graphene Workshop, LNF-INFN, October, 1-2, Frascati, Italy;
2018	**Chair** of the 13th edition of the International LEES Conference (Low Energy Electrodynamics of Solids) June, 24-29 2018, Portonovo (Ancona), Italy;
2017	**Chair** of the Workshop TERADAYS, on applications of terahertz radiation in High-Energy Physics, April 2017, Rome, Italy;
2016	**Co-Chair** of the International Workshop SAFE (Smaller And FastEr: Infrared and Terahertz Spectral-Imaging at the Nanoscale with Synchrotron Radiation and Free Electron Laser Sources), December 2017, Trieste, Italy;
2014	**Chair** of the International Workshop SuperFox (Superconductivity and Functional Oxides), September 2014, Rome, Italy;
2013	**Co-Chair** of the China-Italy bilateral Workshop on new generation infrared sources, December 2013, Beijing (China);
2011	**Chair** of the 6th International Workshop on "Infrared Microscopy and Spectroscopy with Accelerator Based Sources (WIRMS-2011)", September, 2011, Trieste, Italy;
2004	**Co-Chair** of the International Workshop on "Infrared Microscopy and Spectroscopy with Advanced Light Sources", October 2004, Trieste, Italy;

Part XI - Funding Information as PI-principal investigator

Year	Title	Program	Grant value
2018-2021	TERA: Terahertz-ERA	Call Gruppo V INFN	**634,5 k€**
2018-2020	Graphehe-Flagship	WP13-Core2	**110 k€**
2019-2021	3-Dimensional Graphene: Applications in Catalysis, Photoacoustics and Plasmonics;	MAECI Executive Program of cooperation in the field of science and technology, Italy-China;	**152 k€** in 2019-2020
2017-2019	Linear, non-linear, and time-resolved Terahertz spectroscopy	MAECI Executive Program of cooperation in the field of science and technology, Italy-	**121 k€**

	using the latest radiation sources;	Japan;	
2017-2018	THz&RD: Terahertz Research and Developments: Biomedicine Imaging with Terahertz Radiation;	Gruppo-V INFN	**119,5 k€**
2018-2020	"Valutazione dell'effetto immunogenico di nanoparticelle superparamagnetiche (YFe2O3@Ag) come piattaforma per lo sviluppo e il controllo di adiuvanti nei vaccini"	CNR-NRC Executive Program of cooperation in the field of science and technology, Italy-Egypt	**15 k€**
2013-2016	Infrared and Terahertz Spectroscopy at the SISSI and TERAFERMI facilities;	EUROFEL-CNR Activities	**150 k€**
2013-2015	Terahertz Pump-Probe Spectroscopy: SL_FEMTOTERA	Gruppo-V INFN	**250 k€**
2011-2013	Terahertz Ultrashort Electron Beam Diagnostic: TERASPARC	Gruppo-V INFN	**163 k€**
2012	Fundamental properties and Applications of 2-Dimensional Dirac Electron Gases in Topological Insulators	Progetto Ricerca Sapienza	**50 k€**
2009	Pump-Probe Terahertz Spectroscopy	Sapienza AST	**10 k€**
2007	Infrared Spectroscopy on materials of Physical, Geological, and Chemical interest at high-pressure	Sapienza Grandi e Medie Attrezzature	**60 k€**
2005	Metal-Insulator Transition in Cuprates	Ateneo Sapienza	**20 k€**
2004	Developments of an Infrared Synchrotron Beamline at the Elettra Synchrotron, Trieste, Italy	Elettra Sincrotrone/CNR	**1 M€**

Total funding as PI 2,855 M€

Part XII – Research Activities

The research activity developed in these years has been focalized on the exotic low-energy excitations in condensed matter physics ranging from Dirac electrons in Topological Insulators and graphene, High-Tc superconductors, strongly correlated electronic systems, plasmonics, metamaterials, and Biophysics.
Specific electromagnetic sources in the Terahertz (THz) and Infrared (IR) spectral range, have been built for investigating the optical properties of these system and, in the most of cases, those sources have been also open to external users. Recently high-intensity THz radiation has been produced for efficiently accelerate electrons for high-energy physics experiments.
In the following I will summarize my activities and the main achieved results.

1. The low-energy electrodynamics of exotic electronic materials based on Dirac and Weyl electrons and their applications for non-linear terahertz optics, plasmonics, terahertz detectors and photoacoustic.

Most of materials in condensed matter physics are characterized by low-energy electronic excitations showing a quadratic energy/momentum dispersion (Schrodinger electrons).
Only recently, electrons with a linear energy/momentum (relativistic) dispersion (massless Dirac carriers), have been discovered first in graphene, and after in Topological Insulators and Weyl systems, and their potentialities in the fields of plasmonics and photonics have been readily recognized, leading to different applications in active and tunable optical devices.
Our recent research concerns the applications of Dirac electronic systems in terahertz optics in which we discovered a saturable absorption effect and tunable plasmon excitations in Topological Insulators.
Another research regards the plasmonic absorption in three-dimensional nanoporous graphene, where a Nature Communications paper has been published at the beginning of 2017. A patent has been also submitted on the use of the three-dimensional graphene for photoacoustic and terahertz detector applications [European Patent Nr. 16 189 004.1].
Stefano Lupi is the responsible of the laboratory SapienzaTerahertz at the Department of Physics, Sapienza University, Rome, Italy (https://sites.google.com/uniroma1.it/sapienza-terahertz/home), which includes 3 post-docs, 2 PhD students, 1 associate professor;

2. The optical, infrared and terahertz properties using conventional and synchrotron radiation of strongly correlated electronic materials as High-Tc superconductors (HCTS), transitional metal oxides (TMO) and 2D dimensional electron gases (2DEG);

Strongly correlated electronic materials (HCTS, TMO and 2DEG) represent one of the most important class of unconventional systems in Solid State Physics. Those systems are often characterized by a strong interplay of lattice, orbital, charge and spin degrees of freedom. Their similar energy scales determine competing ground states spanning from superconductivity, charge-ordering insulators, bad-metals etc etc. A transformation among those states can be obtained by changing external parameters like temperature, pressure and doping and this often corresponds to a Metal-to-Insulator Transition (MIT).
As a MIT strongly affects the low-energy electrodynamics, spectroscopic measurements from THz to UV may furnish information about:

- The optical conductivity as a function of frequency;
- The spectral weight of the Cooper condensate;
- The charge-ordering gap;
- The phononic excitations;
- The bosonic glue in superconductors;
- The low-energy modes associated to charge-ordering, Spin-Density-Wave and Charge-Density-Wave instabilities;

In the HCTS, for instance, we studied the -T *vs* doping x- phase diagram both in $Nd_{2-x}Ce_xCuO_4$ electron-doped and in $La_{2-x}Sr_xCuO_4$ and $Bi_{2-x}La_xSrCuO_6$ hole-doped materials. This investigation suggests that in the HCTS normal phase incoherent and coherent charge carriers coexist in the Cu-O planes. The strong correlation also influences at high-temperature the charge electrodynamics. Here, we observed for the first time a strong renormalization of the Fermi-liquid and a tendency of reduction of quasi-particles coherence. Through the optical spectral weight dependences on T, we obtained a quantitative measurement of electronic correlation in many materials.
Frequency domain spectroscopic studies have been also extended in the time domain showing the presence of two bosons in the superconducting glue through fs-based pump-probe spectroscopy. THz spectroscopy provided the possibility to measure the Cooper gap and the superconducting properties in new superconductors like cuprates, MgB_2, boron-doped diamond, pictines and K_3C_{60}.

Our measurements demonstrated, for instance, that diamond is a weak-coupling system showing a s-wave gap symmetry and in K_3C_{60} superconductivity can be enhanced by optically pumping specific phonon modes. Another fruitful field of research concerns the physics of Transition Metal Oxides and strongly correlated systems. On this ground, we investigated the MIT through a combination of different experimental techniques: Raman, Photoemission, Infrared, performed in extreme conditions High-Pressure/High-Low Temperature. In particular, we revealed a metallic state induced in VO_2 above 15 GPa, in its monoclinic phase. In V_2O_3, we observed for the first time a mesoscopic electronic phase separation across the MIT induced by pressure and temperature.

3. Plasmonics and Metamaterials.

A major role in metal optics is played by meta and plasmonic materials. These artificial systems can be fabricated by electron lithography and show several properties like super-transmittance, localization of electromagnetic field on sub-wavelength spatial scales, strong dependence of optical response to a small variation of physical properties at interfaces. We built-up a mid-IR plasmonic sensor which is sensitive to femtomoles of organic molecules. We also investigated THz plasmonic materials in order to probe the collective modes of macromolecules. We also studied the THz plasmonic response of metamaterials based on unconventional metals like HCTS and Topological Insulators, as their strong dependence on temperature and applied electric field, provides the possibility to modulate their plasmonic response. Moreover, we are studying the 2DEG forming at oxide interfaces. These gases could have interesting applications for tunable plasmonics.

4. The development of new sources and new instrumentations for infrared and terahertz spectroscopy.

Most of the low-energy excitations characterizing the ground states of exotic materials (see above) fall in the Terahertz and Infrared spectral range. Their spectroscopic investigation in frequency and time domain asks for new radiation sources providing high-brilliance, an improved temporal and spatial stability and a sub-ps time resolution.
In this regard, Infrared Synchrotron Radiation (IRSR) coupling high-brilliance with a large spectral coverage has completely modified Infrared Spectroscopy and Microscopy, providing the possibility to perform previously unexplored experiments:

- Spectroscopy and Micro-Spectroscopy using diamond anvil cells for high-pressure experiments in the 10-100 GPa range;
- Micro-Chemical analysis of non-omogeneous systems;
- Spectroscopy of biological materials on the cellular spatial scales;
- Spectroscopy and spectromicroscopy on Geology and Cultural Heritage;

The SISSI beamline at ELETTRA, which collects both standard and edge radiation from a bending magnet, is one of the most performant infrared beamline in Europe. SISSI has been projected, mounted and characterized in the last years by S. Lupi through a collaboration between ELETTRA-Sincrotrone Trieste, INFM/CNR and University of Rome La Sapienza (see CNR declaration).
SISSI provides the possibility to perform spectroscopy and microspectroscopy measurements at the diffraction limit in the infrared range. The brilliance gain of SISSI has been used for reflectivity measurements at high pressure in diamond anvil cells and for infrared imaging in Biophysics. Recently, IRSR has been extended to low frequency in order to cover the THz region where a flux gain of about 4 order of magnitude with respect to conventional sources has been achieved. Steady-state THz radiation is extremely important for investigating the low-energy excitations in many field of science like collective modes in macromolecules, coherent modes in superconductors and

CDW/SDW materials, the superconducting gap in exotic superconductors, etc, etc (see above).
Recently we have added to the beamline a Nano-Spectroscopy facility based on Tip-Enhanced AFM scanning probe system which provides from THz to IR a spatial resolution well beyond the diffraction limit down to nearly 20 nm.
***S. Lupi is responsible of the material science branch of the SISSI Infrared beamline at Trieste* (see CNR declaration).**

Recently high-power, sub-ps pulsed THz radiation has been realized to play a fundamental role in pump-probe and non-linear experiments. Indeed, sub-ps THz pulses can be used to a resonantly pumping of low-energy modes and studying their relaxation towards the equilibrium. At high-intensity, this radiation may be used to modify the ground state of systems, providing a pure quantum control of matter.
On this ground we started the FEMTOTERA project for extracting and using the THz radiation at the Free Electron Laser SPARC-INFN in Frascati, Italy. Through this project, within a collaboration between INFN and University of Rome La Sapienza, we produced 100 fs/25 microJoule pulsed THz radiation. This THz source is strongly competitive and THz Pump-THz Probe experiments have been performed and others are on going.
S. Lupi has in charge the scientific activity of the THz project in Frascati, Italy.

A new Terahertz project has been proposed to the Fermi@Elettra free electron laser in 2010. This project that concerns the development of a Terahertz beamline at the Fermi machine has been approved in 2013 and financed through a collaboration among CNR and ELETTRA. The THz beamline TERAFERMI emits THz pulses with a time duration of 50 fs, covering a spectral range up to 10 THz. The energy per pulse reached 100 microJ, which corresponds to a THz electric field of about 10 MV/cm (the atomic electric field). The beamline has been open to external users in January 2017.
S. Lupi is co-responsible of the scientific activity of the THz project at Fermi.

5. The infrared and terahertz investigation of materials with biophysical interest;

We have been studied mid-IR spectra of monolayers and bilayers of binary mixing of phosfolipids in order to obtain information on the phase separation phenomena existing in these systems. Moreover, we have investigated the modification of enzyme secondary structure in proteins attached to nanocarriers. Recently, I proposed a project for using THz and Near-IR radiation for biomedical imaging on skin-cancer. This project has been financed by INFN (see above).

6. THz Acceleration: The TERA Project;

Recently through a competitive CALL (PI Stefano Lupi), INFN funded a project for producing and using a highly intense THz radiation (THz electric field up to 50 MV/cm) for accelerating electrons. Indeed, the long wavelength of THz radiation (100 um) and the associated huge THz field may provide the possibility to strongly increase the acceleration efficiency for electrons allowing the developing of short accelerators useful in many applications, for instance in biomedicine. This project has been financed with 800 k€ in three years and the TERA Laboratory has been founded through a collaboration between Sapienza University and INFN in Rome.
S. Lupi is responsible of this project (see INFN declaration).

Part XIII – Summary of Scientific Achievements

Product type	Number	Data Base	Start	End
Papers [International]	284	SCOPUS	1989	2020

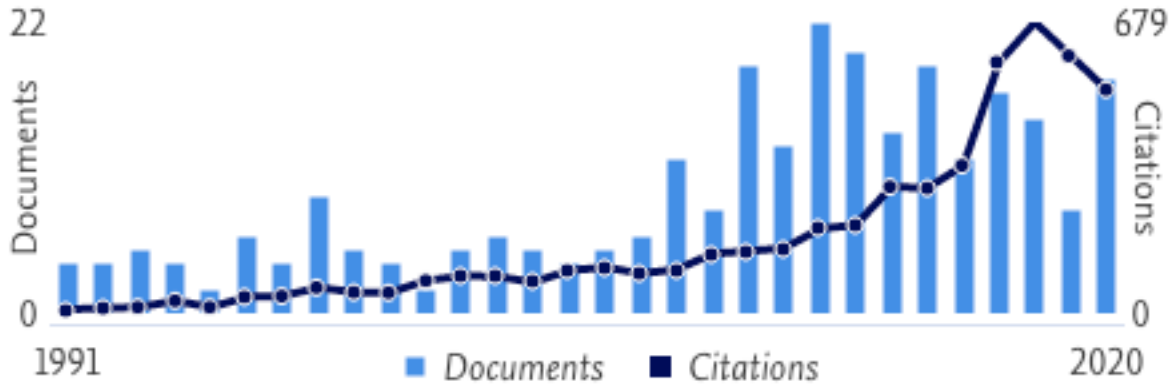
Numbers of Talk in International Conferences/Workshops	2 Plenary+72 Invited+14 Contributed		1989	2020
Book Chapter [scientific]	4	ISI+SCOPUS	1989	2020

Total Impact Factor (1989-2020)	1003
Average Impact Factor/Paper	3.55
Total Citations	4663
Average Citations/Paper	16.42
h-index (SCOPUS)	37

Last 15 years

Product type	Number	Data Base	Start	End
Papers [International]	208	SCOPUS	2006	2020
Book Chapter [scientific]	4	ISI+SCOPUS	2006	2020

Total Citations	4263
Average Citations/Paper	20.5
h-index (SCOPUS)	29



Among publications:

1 Nature;
1 Nature Nanotechnology;
2 Nature Physics;
6 Nature Communications;
1 Advanced Functional Materials;
3 Nano Letters;
1 ACS Nano;
20 Phys. Rev. Letters;
1 Applied Materials Today;

1 Nanoscale;
1 Advanced Optical Materials;
3 ACS Photonics;
8 Nature Scientific Reports;

Invited Talks (2006-2020)

1. 12th International Hasselt Diamond Workshop, February 28-March 2, 2007, Hasselt University, Belgium, Synchrotron Infrared Experiments on Superconducting Diamond and related materials
2. SILS 2007, July, 6-8 2007, Camerino, Italy, Extraction of Coherent Synchrotron Radiation from a LINAC for Terahertz Spectroscopy
3. Synchrotron Radiation School 2007, Duino, Trieste, Italy, Infrared Synchrotron Radiation: Spectroscopy And Microscopy
4. LEES 2008, June 30 - July 4, 2008 Vancouver, Canada, Low-Energy Electrodynamics and Metal to Insulator Transition in strongly correlated Vanadium Oxides
5. SILS 2008, June 26-28, 2008, Palermo, Italy, How to produce broad-band *sub-ps* low-energy pulses at UV and X-Ray FELs?
6. META Conference, 2008, Growth and optical characterization of Metamaterials for THz applications
7. Synchrotron Radiation School 2009, Grado, Trieste, Italy, Infrared Synchrotron Radiation: Spectroscopy And Microscopy
8. SILS 2009, 24-26 June, 2009, Camerino, Italy, Infrared synchrotron radiation spectroscopy at high-pressure in exotic materials
9. CIMTEC 2010, June 6-18, 2010, Montecatini Terme, Italy, Terahertz Spectroscopy of Superconductors
10. ETACM Meeting 2010 October 6 – 8, 2010, Anacapri, Naples, Italy, Observing The Mott Transition In V_2O_3 at the Microscale
11. IRMMW-THz 2010, September 5-10 2010, Rome Italy, Production of High Power Terahertz Radiation through the Free-Electron Laser
12. LEES 2010, July 5-10, 2010, Switzerland, Low Energy Electrodynamics and Metal to Insulator Transition in V_2O_3
13. Synchrotron Radiation School 2011, Grado, Trieste, Italy, Infrared Synchrotron Radiation: Spectroscopy And Microscopy
14. LEES 2012, July 22-27, 2012, Napa Valley, California, USA, Optical Properties of Bismuth-based Topological Insulators
15. Workshop on High-Field THz Science, October 8-9, 2012, University of Pécs, Hungary, Linear and Pump-Probe applications of THz Spectroscopy: The case of Elettra, Bessy-II, and SPARC
16. ESCA 2012, 18 - 22 November 2012, Hurghada, Red Sea, Egypt, Raman and I. R. Characterizations of Protein and Bio-Molecular Materials
17. MAMA Conference, March 20-22, 2012, Vieste, Italy, Electronic Phase Separation and Metal-to-Insulator Transition in V2O3 Mott-Hubbard material
18. Synchrotron Radiation School 2013, Grado, Trieste, Italy, Infrared Synchrotron Radiation: Spectroscopy And Microscopy
19. FisMat 2013 9-13 September 2013, Milano, Italy, Plasmonics Excitations in Topological Insulators
20. MAMA Trend Conference, May 20-23, 2013, Sorrento, Italy, Plasmonic Excitations in the Topological Insulators
21. Italo/Chinese Bilateral Workshop, December 4-5, 2013, Beijing, China, Infrared and Terahertz steady-state and time-resolved experiments with Storage rings and Free Electron

Lasers

22. SIF, September 24-26, 2013 Trieste, Italy, Linear and Pump-Probe Terahertz Spectroscopy: The case of Elettra and SPARC
23. TeraHertz Science and Technology 2014 EOS – EUROPEAN OPTICAL SOCIETY, May 11-14, 2014, Camogli, Italy, Terahertz Plasmonic Excitations in Topological Insulators
24. LEES 2014, June 29-July 4, 2014, Loire Valley, France, Plasmonic Excitations in Topological Insulators
25. Workshop Magnetism at Large Scale Facilities November 24-25, 2014 CNR Roma, Italy, Behavior of Dirac plasmons under a strong magnetic field in topological insulators
26. THz-Arte, December 2-3, 2014, Frascati-ENEA, Italy, Terahertz Bio-Sensing based on Extraodinary Trasmission Devices
27. 8th International Congress on Advanced Electromagnetic Materials in Microwaves and Optics Metamaterials 2014, 25-30 July, Copenhagen, Denmark, Terahertz Plasmonic Excitations in Bi_2Se_3 Topological Insulator
28. FisMat 2015, September 28 - October 2, 2015, Palermo, Italy, Dirac Plasmonic Excitations In Topological Insulators
29. THz Workshop, November 15-18, 2015, Mephi University, Russia, Terahertz Radiation for Frequency and Time-Resolved Spectroscopy at SPARC-LAB Facility
30. Nanoscience and Nanotechnology Conference, INFN-LNF September 28-October 2, 2015, Frascati, Rome, Italy, Low-Energy Excitations in Topological Insulators
31. NEEM 2015 Workshop, October 12-14, 2015, Rome, Italy, Plasmons in 3D Nanoporous Graphene
32. RAIN Conference, July 13-15, 2015, Rome CNR, Terahertz Spectroscopy and Imaging
33. SIF, October 27-30, 2015, Napoli, Italy, Insulator-to-Metal Transition and Magnetism in Oxides
34. Synchrotron Radiation School 2015, Grado, Trieste, Infrared Synchrotron Radiation: Spectroscopy And Microscopy
35. *ACSIN 2016* 13th International Conference on Atomically Controlled Surfaces, Interfaces and Nanostructures. October 9-15, 2016, Frascati, Rome, Italy, Terahertz Optical Properties Of Topological Insulators
36. LEES 2016, May 29 - June 3, 2016, Japan, Non-Linear Terahertz Behavior of Bi_2Se_3 Topological Insulators
37. Ugo Fano Symposium, 19-21 October 2016, CNR-Rome, Italy, Fano Effects In Exotic Electronic Materials: From Light To Sound
38. SILS 2016, September 21-23, 2016, Bari, Italy, Highly-Intense and Sub-ps Linac-Based Terahertz Sources for Non-Linear and Pump-Probe Spectroscopy
39. SuperFox 2016, September 19-21, 2016, Politecnico Torino, Italy,3D Graphene
40. Advanced Accelerator & Radiation Physics Workshop, December 7-8, 2016 Moscow, Russia, Terahertz Radiation for Linear and Non-Linear Spectroscopy in Condensed Matter Physics
41. Synchrotron Radiation School 2017, Muggia, Trieste, Italy, Synchrotron and Free Electron Laser based Infrared and Terahertz Studies in Condensed Matter
42. Superfluctuations 2017, September 6–8, 2017, San Benedetto del Tronto, Italy, Non Linear Electrodynamics Response in Dirac Electron Materials
43. 21th International Conference on Solid State Ionics, June 18-23, 2017, Padova, Italy, Sound and Light in 3D Graphene
44. ICFO, January 18, 2017, Barcelona, Spain, Light and Sound in Three-Dimensional Graphene
45. CLEO 2018 San Jose Convention Center, San Jose, CA, USA, Dirac Plasmons in Topological Insulators

46. N2D Workshop July 30-August 3, 2018, San Sebastian, Spain, Dirac Plasmons in Topological Insulators and 3D Graphene
47. 3D Graphene Workshop, October 1-2, 2018, Sapienza University of Rome, Italy, Terahertz and Infrared Plasmonic Absorption of 3-Dimensional Nano Porous Graphene
48. Photonics North 2018, June 5-7, 2018 Montreal, Canada, Non Linear Electrodynamics Response in Dirac Electron Materials
49. EMN Conference, September 3-7, 2018 San Sebastian, Spain, Non-Linear Terahertz Properties of Topological Insulators
50. Superfluctuations 2018, September 5–7, 2018, San Benedetto del Tronto, Italy, Non Linear Terahertz Response of Exotic Electronic Materials
51. Frontiers On Quantum Matter, June 11-15, 2018, Frascati, Rome, Italy, Linear and Non Linear Terahertz Photonics Based On Topological Matter
52. FisMat 2019, September 30-October 4, 2019, Catania, Italy, High Intensity Terahertz and Mid-Infrared Radiation: Opportunity for Condensed Matter Physics
53. META 2019 July 23 – 26, 2019, Lisbon, Portugal, Non Linear Single-Particle and Plasmonic Terahertz Properties of 3D Topological Insulators
54. Workshop for NSFC NSFC-MAECI, November 26, 2019 Beijing, China, Sound and Ligth in 3D Graphene
55. Synchrotron Radiation School 2019, Muggia, Trieste, Italy, Synchrotron and Free Electron Laser based Infrared and Terahertz Studies in Condensed Matter
56. SILS 2019, 9-11 September, 2019, Camerino, Italy, High-Intensity Terahertz and Mid-Infrared Radiation: Production and Opportunities in Condensed Matter Research;
57. SILS 2019 Workshop on Coherence, 9-11 September, 2019, Camerino, Italy Terahertz and Infrared Synchrotron Radiation: Coherence helps its use?
58. Superfluctuations 2019, September 2-4, 2019, University of Padova, Italy, Sound and Light in 3D Graphene
59. SuperFox 2020, February 10-12, 2020, Santa Margherita Ligure, Italy, Ultrafast Manipulation of Matter By Extreme Terahertz Fields
60. Frontiers in Quantum Materials for Quantum Computing, October 26-27, 2020, Russian Center for Science and Culture, Rome, Italy, Linear and non linear terahertz photonics based on topological matter
61. APS Mid-Atlantic Conference, 4-6 December, 2020, online conference USA, Linear and Unlinear Terahertz Behavior of Topological Insulators Materials

Part XIV- Patent

I have a patent (European Patent Nr. 16 189 004.1) on:

Transducer for electromagnetic and thermo-acoustic wave based on three dimensional graphene structure

Part XV– Selected Publications

1. Terahertz Tuning of Dirac Plasmons in Bi2Se3 Topological Insulator
P. Di Pietro, N. Adhlakha, Piccirilli, A. Di Gaspare, J. Moon, S. Oh, Di Mitri, S. Spampinati, A. Perucchi, S. Lupi
Physical Review Letters 124, 226403 (2020), DOI: 10.1103/PhysRevLett.124.226403

2. Overcoming the thermal regime for the electric-field driven Mott transition in vanadium sesquioxide
F. Giorgianni, J. Sakai, and S. Lupi

Nature Communications 10, 1159 (2019), https://doi.org/10.1038/s41467-019-09137-6

3. Optical Conductivity of Two-Dimensional Silicon: Evidence of Dirac Electrodynamics
C. Grazianetti, S. De Rosa, C. Martella, P. Targa, D. Codegoni, P. Gori, O. Pulci, A. Molle, and S. Lupi
Nano Lett. 18, 7124 (2018), DOI: 10.1021/acs.nanolett.8b03169

4. Reshaping the phonon energy landscape of nanocrystals inside a terahertz plasmonic nanocavity
Xin Jin, A. Cerea, G. C. Messina, A.Rovere, R. Piccoli, F. De Donato, F. Palazon, A. Perucchi, P. Di Pietro, R. Morandotti, S. Lupi,
F. De Angelis, M. Prato 2, A. Toma, and L. Razzari
Nature Communications 9, 763 (2018), DOI: 10.1038/s41467-018-03120

5. High-Efficiency and Low Distortion Photoacoustic Effect in 3D Graphene Sponge
F. Giorgianni, C. Vicario, M. Shalaby, L. D. Tenuzzo, A. Marcelli, T. Zhang, K. Zhao, Y. Chen, C. Hauri, and S. Lupi
Adv. Funct. Mater., 28, 1702652 (2018), DOI: 10.1002/adfm.201702652

6. Terahertz and mid-infrared plasmons in three-dimensional nanoporous graphene
F. D'Apuzzo, A. R. Piacenti, F. Giorgianni, M. Autore, M. Cestelli Guidi,
Marcelli, U. Schade, Y. Ito, M. Chen, and S. Lupi
Nature Communications 8, 14885 (2017) DOI: 10.1038/ncomms14885

7. 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 (2017), DOI: 10.1038/NPHYS4112

8. Possible light-induced superconductivity in K_3C_{60} at high temperature
M. Mitrano, A. Cantaluppi, D. Nicoletti, S. Kaiser, A. Perucchi, S. Lupi, P. Di Pietro, D. Pontiroli, M. Riccò, S. R. Clark, D. Jaksch and A. Cavalleri,
Nature 530, 461 (2016), DOI:10.1038/nature16522

9. Strong nonlinear terahertz response induced by Dirac surface states in Bi2Se3 topological insulator
F. Giorgianni, E. Chiadroni, A. Rovere, M. Cestelli-Guidi, A. Perucchi, M. Bellaveglia, M. Castellano, D. Di Giovenale, G. Di Pirro, M. Ferrario, R. Pompili, C. Vaccarezza, F. Villa, A. Cianchi, A. Mostacci, M. Petrarca, M. Brahlek, N. Koirala, S. Oh and S. Lupi
Nature Communications 7, 11421 (2016), DOI: 10.1038/ncomms11421

10. Snapshots of the retarded interaction of charge carriers with ultrafast fluctuations in cuprates
S. Dal Conte, L. Vidmar, D. Golež, M. Mierzejewski, G. Soavi, S. Peli, F. Banfi, G. Ferrini, R. Comin, B. M. Ludbrook, L. Chauviere, N. D. Zhigadlo, H. Eisaki, M. Greven, S. Lupi, A. Damascelli, D. Brida, M. Capone, J. Bonca, G. Cerullo and C. Giannetti
Nature Physics 11, 421 (2015), DOI:10.1038/nphys3265

11. Spectral Weight Redistribution in (LaNiO3)n/(LaMnO3)2 Superlattices from Optical Spectroscopy
P. Di Pietro, J. Hoffman, A. Bhattacharya,2, S. Lupi, and A. Perucchi

Phys. Rev. Lett. 114, 156801 (2015), DOI: 10.1103/PhysRevLett.114.156801

12. Squeezing terahertz light into nanovolumes: nanoantenna enhanced terahertz spectrscopy (NETS) of semiconductor quantum dots
A.Toma, S. Tuccio, M. Prato, F. De Donato, A. Perucchi, P. Di Pietro, S. Marras, C. Liberale, R. Proietti Zaccaria, F. De Angelis, L. Manna,S. Lupi, E. Di Fabrizio, L. Razzari
Nano Letters 15, 386, (2015), DOI: 10.1021/nl503705w

13. Observation of Dirac plasmons in a topological insulator
P. Di Pietro, M. Ortolani, O. Limaj, A. Di Gaspare, V. Giliberti, F. Giorgianni, M. Brahlek, N. Bansal, N. Koirala, S. Oh, P. Calvani and S. Lupi,
Nature Nanotechnology 8, 556 (2013), DOI: 10.1038/NNANO.2013.134

14. Optical Properties of (SrMnO3)n/(LaMnO3)n Superlattices: An Insulator to Metal Transition observed in the Absence of Disorder
Perucchi, L. Baldassarre, A. Nucara, P. Calvani, C. Adamo, D. G. Schlom, P. Orgiani, L. Maritato, and S. Lupi
Nano Letters, *10*, *4819 (2010), DOI: 10.1021/nl1022628*

15. A microscopic view on the Mott transition in Chromium-doped V_2O_3
S. Lupi, L. Baldassarre, B. Mansart, A. Perucchi, A. Barinov, P. Dudin, E. Papalazarou, F. Rodolakis, J.-P. Rueff, J.-P. Itié, S. Ravy, D. Nicoletti, P. Postorino, P. Hansmann, N. Parragh, A. Toschi, T. Saha-Dasgupta, O. K. Andersen, G. Sangiovanni, K. Held and M. Marsi
Nature Communications 1, Article number: 105 DOI:10.1038/ncomms1109 (2010)

16. High-Temperature Optical Spectral Weight and Fermi-liquid Renormalization in Bi-Based Cuprate Superconductors
D. Nicoletti, O. Limaj, P. Calvani, G. Rohringer, A. Toschi, G. Sangiovanni, M. Capone, K. Held, S. Ono, Yoichi Ando, and S. Lupi
Phys. Rev. Lett. 105, 077002 (2010), DOI: 10.1103/PhysRevLett.105.077002

Rome, 10/11/2020

Stefano Lupi