Luca Sacchi @ lsacchi@g.harvard.edu, (617)2331439, 103 Gore St, 02142 Cambridge, MA

Education

Visiting Scholar, Harvard SEAS — Cambridge, USA
Visiting Scholar in Prof. Capasso's group — *Jan. 2024 - Present*

M.Sc. in Physics, ETH Zürich — Zürich, Switzerland
Taught in English. Graduate courses listed below. GPA 5.78/6. — *Sep. 2021 - Dec. 2024*

- *"Manipulating visible light with metasurfaces: investigation via various material platforms"*

B.Sc. in Physics, Universität Bonn (University of Bonn) — Bonn, Germany
Taught in German. Erasmus visiting student during the second year of bachelor's. — *Oct. 2019 - May 2020*

B.Sc. in Physics, Università degli Studi di Torino (University of Turin) — Turin, Italy
Taught in Italian. Summa cum laude. GPA: 29.43/30 (top 3% of 2021 class). — *Sep. 2018 - Jul. 2021*

- *"The geometrical interpretation of solitons solutions in a Bose-Einstein Condensate"*

Scholarships, Honors, and Awards

Erasmus Scholarship — Bonn, Germany
Granted a Scholarship to attend the University of Bonn as a visiting student. — *Oct. 2019 - May 2020*

Graduated *summa cum laude* — Turin, Italy
Top 3% of the class of 2021. — *Sep. 2018 - Jul. 2021*

Research Experience

Research on Dispersion Engineered and Tunable Metasurfaces (Harvard) — Cambridge, USA
Supervisors: Prof. Federico Capasso, Dr. Joon-Suh Park | Metaoptics. — *Jan. 2024 - Present*

- Dispersion engineered metasurfaces of SiO2, Silk and TiO2. Tunable bylayer metasurfaces (varifocal lens, OAM beam generator). Streatchable metasurface on PDMS.
- Design via forward and inverse design of metasurfaces, using FDTD, RCWA and morphological optimization algorithm.
- Fabbrication tools for deposition (TE, EE, CVD, ALD), wet and dry etching (ICP RIE), e-beam litography, and imaging (SEM, FIB).

Graduate research on ringdown signals of BH mergers (UZH) — Zürich, Switzerland
Supervisors: Prof. Philippe Jetzer, Dr. Eleanor Hamilton | Gravitanal Waves. — *Nov. 2022 - Sep. 2023*

- Analyzing the pro and retrograde QNM content of ringdown signals in aligned-spin binary BH mergers.

Graduate research on USC light-matter interaction (ETH) — Zürich, Switzerland
Lab Supervisors: Prof. Jèrôme Faist, Dr. Johan Andberger | Quantum Optoelectronics. — *Feb. 2022 - May 2022*
Writing of paper, report, and group presentation. — *Sep. 2022 - Nov. 2022*

- Characterization of a time symmetry-breaking chiral cavity via THz-Time domain spectroscopy.
- Worked with Oxford liquid He-cryostat, Photo Conductive Antennas, MaiTai Ti:Sapphire pulsed laser.
- Optimized the experimental setup and measured the transmission spectra of multiple fabricated samples to investigate the lifting of the degeneracy of chiral modes and the emergence of the Ultra Strong Coupling regime in a new gold metamaterial optical cavity.

Research on weak measurements on entangled photons (INRiM) — Turin, Italy
Supervisors: Dr. Marco Genovese, Dr. Fabrizio Piacentini | Quantum Optics. — *Apr. 2021 - Jun. 2021*

- Designed and built the first stages for an experiment to test the CHSH inequality with sequential and joint weak measurements on polarization-entangled photon pairs.
- Worked with Sagnac Interferometer, PPKTP crystals, Calcite Crystal, fiber couplers, SPAD arrays.

Teaching Experience

Teaching Assistant for General Relativity course — Zürich, Switzerland
Graduate course based on Carroll's "Spacetime and Geometry". — *Sep. 2023 - Dec. 2023*

Teaching Assistant for Theoretical Cosmology course — Zürich, Switzerland
Graduate course based on Dodelson's "Modern Cosmology". — *Feb. 2023 - Jun. 2023*

Publications

Johan Andberger, Lorenzo Graziotto, **Luca Sacchi**, Mattias Beck, Giacomo Scalari, and Jèrôme Faist. *Terahertz Chiral Subwavelength Cavities Breaking Time-Reversal Symmetry via Ultrastrong Light-Matter Interaction.*, Physical Review. B, vol. 109, no. 16, 26 Apr. 2024. https://doi.org/10.1103/physrevb.109.l161302.

Work Experience

Project team leader for the NAUTILUS structure team (ARIS & EMPA) Zürich, Switzerland
Part-time work (20 hours per week). *Jan. 2022 - Present*

- Designed a modular Unmanned Underwater Vehicle (UUV) glider which will be used for future research studies of glaciers in Switzerland and at the Poles.
- Developed innovative silicone soft wings based on the emerging field of soft robotics to have better efficiency and maneuverability, enabling the study of small bodies of water with less invasive methods than traditional ROV.
- Built, tested, and integrated various modular units for the UUV.
- Recruited and led a team of 8 people in developing the structure of the UUV, coordinated weekly meetings.
- Negotiated with companies for sponsorship and arranged three new collaborations with firms in the EU and China. Oversaw a collaboration with a high school that enabled senior high school students to work in partnership with ETH. Scaled the sponsorship from 10k CHF to **80k CHF**.
- NAUTILUS is a project in collaboration with ARIS, a 170+ student spin-off of ETH, Imperial College London, and EMPA, the Swiss Federal Laboratories for Materials Science and Technology.

Volunteering and other Experiences

Volunteer sailing instructor at Centro Velico Caprera (CVC) Caprera, Sardinia
CVC is the second oldest and biggest sailing school in Europe with 2000+ volunteers. *Aug. 2018 - Present*

- Taught to, coordinated, and led classes of 30 students of all ages.
- The main responsibilities of this role comprise the ability to foresee dangerous situations and plan accordingly, willingness to work in a calculated-risk environment with the responsibility of all the students, public speaking, and forming a close-knit group.

Divemaster (80+ dives) *Jun. 2022 - Present*
Divemaster is the first professional certification in the diving industry.

- Organized, directed, and supervised dives and briefings. Assisted and conducted various training programs.
- Ability to operate in a stressful unnatural environment, to enact SAR plans to possibly life-threatening situations, and to assess the hazards of a dive site for the divers' safety.

Languages and Skills

Languages: Italian (native), English (advanced, TOEFL 115/120), German (intermediate B2 Goethe course).
Programming languages: Intermediate: Python, Matlab. Basic: C++, Mathematica.
Member: MENSA International, ARIS.

Interests

I have sailed most of my life (2000+ nautical miles) and I circumnavigated Italy in the summer of 2021 to explore the different customs and traditions of my beautiful motherland: marinas and ports brim with local culture and life. Hopefully one day I will do a solo ocean crossing. In the future, I plan to visit the many wonders of Tanzania: Ngorongoro Crater, Lake Victoria, the Serengeti Migration, Mount Kilimanjaro and meet the Maasai. Finally, I will study to get the Gliding Pilot Licence and *sail* the skies.