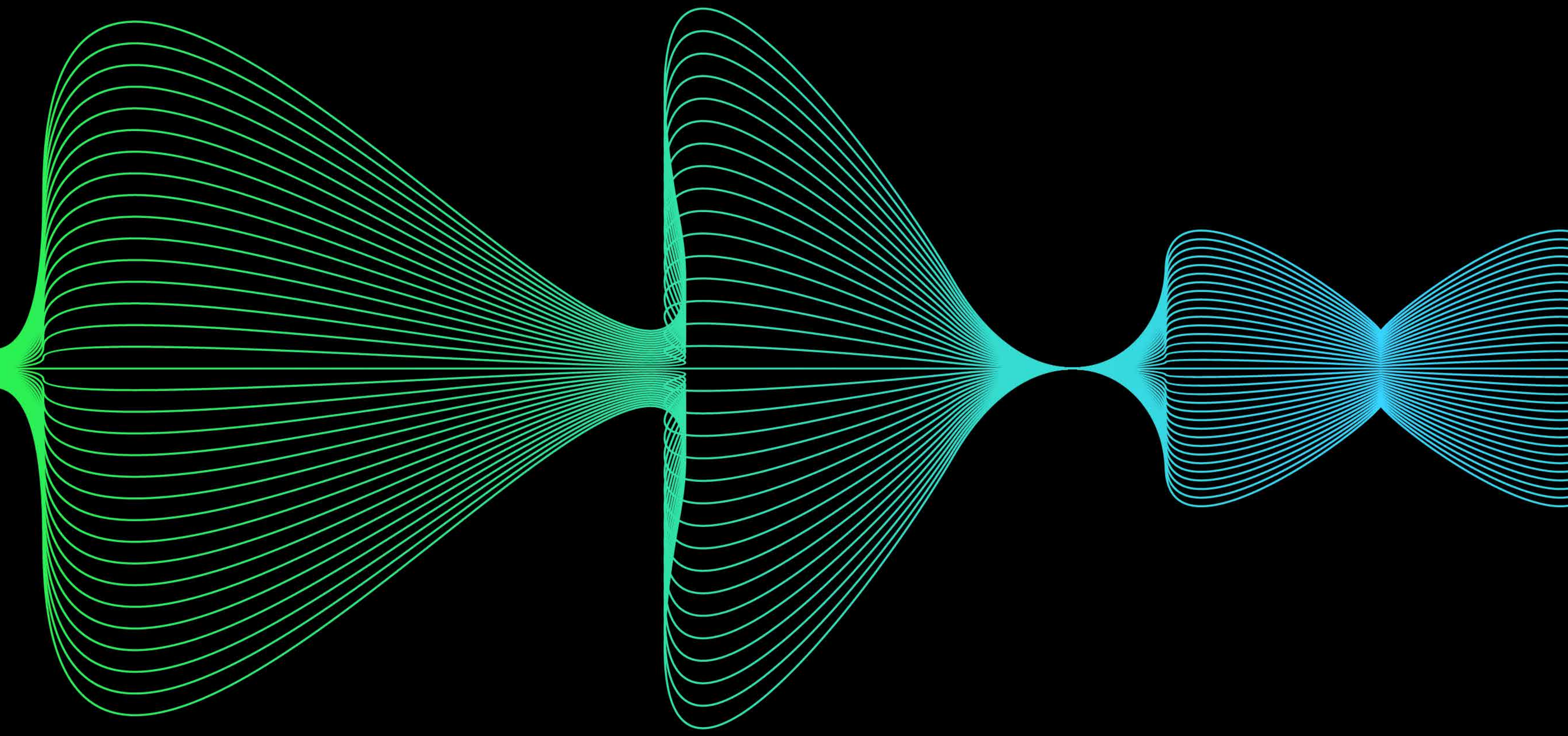
Evento organizzato nell’ambito di Engineering Physics Colloquia



Ca’ Foscari University of Venice
Department of Molecular Sciences and Nanosystems

A Scanless Approach to Terahertz Time-Domain Imaging

15 aprile 2025, 11.00
Conference Room Orio Zanetto, Alfa Building

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Terahertz imaging based on time-domain spectroscopy is a powerful tool, e.g., to spatially resolve the refractive index and absorption properties of materials, as well as to reveal the inner structure of certain optically opaque objects. However, this imaging method is typically hampered by the long acquisition time required to scan the object pixel by pixel and, for each spatial point, record the terahertz electric field in time by means of a delay line. In this talk, I will present our approach to address this issue. First, we implemented a time-domain single-pixel imaging configuration that avoids the spatial scan and makes it possible to use compressed sensing for a quicker reconstruction. In this way, we demonstrated the indirect coherent extraction of the terahertz temporal waveform for each spatial position of the object. Second, we integrated into the imaging system a scanless terahertz waveform detection scheme. We showed that by properly exploiting wave diffraction, time-to-space encoding applied to terahertz point detection allows for the effective retrieval of the terahertz waveforms, significantly reducing both system complexity and acquisition time. Finally, we exploited our imaging technique for the characterization of spiral phase plates fabricated via two-photon polymerization lithography. The latter is a three-dimensional printing method featuring high resolution and low surface roughness, which enables the fabrication of high-frequency (> 0.4 THz) terahertz devices. The vortex beams generated by the spiral phase plates were spectrally reconstructed at varying distances along propagation.