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# SABINA and SISSI 2.0: Two Underway Projects for Innovative THz/IR Sources Based on Particle Accelerators

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Terahertz/Infrared (THz/IR) radiation and technologies have witnessed incredible development in recent decades owing to their application in a great variety of fields, ranging from scientific research in physics, medicine and biology to research topics closer to our daily lives, such as communications, security or environmental science. In order to push the boundaries of research in all these fields, it is necessary to develop innovative technologies that enable the generation, manipulation and detection of THz/IR radiation, a task that is part of an existing framework aimed at filling the so called 'THz Gap'. Among the sources that embrace this spirit of innovation, those based on particle acceleration could provide high-power THz and IR radiation with tunable properties in terms of time duration, frequency spectrum and polarization.

Two Italian projects, SABINA and SISSI 2.0, are currently underway for the realization or the upgrade of innovative THz/IR sources based on particle acceleration. These projects include two of the most important research facilities in Italy, i.e. the SPARC_LAB linear accelerator at the National Laboratories of Frascati (INFN-LNF) and the third-generation synchrotron, Elettra, in Trieste.

The SABINA project aims to implement some major upgrades to the SPARC_LAB structure, including the practical goal of realizing a FEL, operating as an external user facility. A sequence of three APPLE-X undulators downstream a LINAC are used to produce pulsed monochromatic radiation in the spectral range 3-30 THz, with energy up to ~100 μm/pulse, with time durations in the sub-ps/ps range and with tunable polarization (circular, elliptical and linear). The radiation is transported through an optical beamline to an external 'open-to-user' laboratory, equipped with appropriate set-ups to perform scientific experiments concerning non-linear and time-resolved optical spectroscopy.

In the same spirit of innovation, the SISSI 2.0 project is part of a more general upgrade, ELETTRA 2.0, that is intended to create an 'ultimate' light source, characterised by a substantial increase in brilliance and coherence, through the implementation of new magnetic optics designed to preserve the basic features of the accelerator. All the beamlines are involved in the upgrade, including SISSI (Synchrotron Infrared Source for Spectroscopy and Imaging), which is the line dedicated to the collection of THz/IR radiation emitted by magnetic dipoles. The SISSI 2.0 Project aims to characterize the radiation produced by this beamline focusing on the interference effects and on the emergence of new edge radiation contributions caused by the complex magnetic structure of the new multi-bend achromats.

## I plan to submit also conference proceedings

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