



# PhD offer

At IETR (Institut d'Electronique et des Technologies du numéRique) UMR CNRS 6164  
and Institut Foton UMR CNRS 6082, France

## PHOTOMIXING ANTENNA ARRAYS FOR TERAHERTZ WIRELESS COMMUNICATIONS

### Project context

Wireless data traffic increases by a factor of 100 every 10 years and, in 10 years' time, we will have to provide data rates of even Tb/s. Given Shannon's limit, a more efficient use of available spectrum will not suffice to reach the predicted data rates. The use of *carrier frequencies in the sub-Terahertz* (sub-THz) regime (between 100 GHz and 1 THz) *will be pivotal* to achieve the total bandwidths (BW) required for front- and back-hauling *in beyond 5G systems*, ultra-high definition multimedia streaming and data centers. Moreover, sub-THz frequencies have not yet been allocated and they present atmospheric transmission windows with attenuation below 10 dB/km. To enable the use of this frequency band, we will need adequate front-ends with high gain and beam steering capabilities to receive/transmit efficiently in point-to-point and point-to-multipoint scenarios.

The first challenge in sub-THz wireless communications consists in *designing high-gain antennas* efficiently coupled to continuous-wave THz sources at room temperature, to compensate for the propagation losses. The second hurdle lies in the lack of *sources with adequate output power* in the sub-THz range. Finally, one must provide *beam steering capabilities* to guarantee an excellent alignment of the required narrow beams.

### Objectives of the PhD offer

The overall objective of this thesis will be to develop sub-THz front-ends by photonic generation with several disruptive proofs of concepts at international level:

- One of the first *high-gain photomixing antenna array* with broad bandwidth. We will investigate the integration of UTC-photodiodes with planar wideband antennas. Special attention will be paid to *find the most appropriate materials and fabrication techniques* for these arrays.
- The developed photomixing arrays will also provide *beam steering capabilities*. By bringing one fiber to each photodetector, it is possible to control the phase of each element with true time delay and provide either beam steering or multiple beams.
- Implement currently developed dual frequency optical sources to achieve the sub-THz carrier compatible with photo-mixer arrays.
- Last but not least, the realized *prototypes will be measured* at IETR/Institut Foton facilities, and real-time high data rates over medium or long distances in *point-to-multipoint scenarios*.

### Candidate

*Required education level:* Master or equivalent degree in electrical engineering or physics.

*Duration:* 36 months.

*Required background:* antenna theory, microwave engineering, microwave photonics, Terahertz radiation. Knowledge of French is not required.

Deadline to apply: as soon as possible, firm deadline : Sep. 15, 2021.

### Contact persons

To apply please send your motivation letter, CV, and recommendation letters (optional) to:

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All candidatures will be evaluated. However, due to the large number of applications we receive, we will contact only the short-listed candidates.