



PhD Offer

(IETR/IPR, Rennes, France)

Optically-Reconfigurable Transmitarray Antennas at Millimeter Waves

- **Key words**

Transmitarray antennas, Reconfigurable antennas, Optical control

- **Context and overview of the problem**

Transmitarray antennas have become very popular for a plethora of millimeter-wave applications (like in Ka-band around 20/30 GHz for satellite communications and broadband internet access, or ultra-high speed point-to-point links and heterogeneous wireless networks in the 60- and 70/80-GHz bands); they offer unique advantages in terms of performance and flexibility. Transmitarrays are formed typically by an arrangement of half-wavelength unit-cells which collimate the radiation of a focal source by locally shifting the phase of the transmitted waves. If this phase shift is controlled electronically, a reconfigurable antenna is obtained with beam-forming and beam-steering capabilities.

Nevertheless, for many applications, especially at very high frequencies, integrating and routing the bias lines to control *electrically* the transmission phase becomes extremely challenging at millimeter waves, even impossible. For this reason, alternative control solutions must be invented.

The solution selected here consists in integrating optically-controlled photoconductive microwave materials in the unit-cell to control its transmission phase, thus the radiation performance of the entire antenna array. IETR (www.ietr.fr) and IPR (<https://ipr.univ-rennes1.fr/>) have been cooperating on this ambitious and challenging research project for several years in tight collaboration with Drexel University, Philadelphia, USA.

- **Description of work**

The aim of this PhD project is to carry on with the design, optimization, prototyping and characterization of advanced unit-cells and optically-reconfigurable transmitarray antennas at millimeter waves. The thesis is organized into four main steps:

- Detailed bibliography study on optically-reconfigurable antennas and interaction laser matter,
- Design and characterization of advanced transmitarray unit-cells,
- Design and characterization of a fully reconfigurable transmitarray antenna with integrated optical control of the antenna performance for multiple beam and beam shaping applications,
- Investigation of possible new alternatives.

- **Candidate profile**

The PhD candidate should hold a Master degree (M2R) or an equivalent title recognized by the doctoral school MATISSE (<http://matisse.ueb.eu/eng/>), in **electrical engineering (microwaves)** with good competences in **optics**. In particular, the candidate should master electromagnetic theory, microwave theory, antennas and circuit analysis, semiconductor physics, fiber optics, and should have basic knowledge in laser physics. A good level of spoken and written English is required.

- **How to apply?**

Interested candidate should send a detailed CV, a motivation letter, a recommendation letter by email to:

⇒ Ronan SAULEAU, IETR (www.ietr.fr), université de Rennes 1 (Ronan.Sauleau@univ-rennes1.fr)

⇒ Mehdi ALOUINI, IPR (<https://ipr.univ-rennes1.fr/>), université de Rennes 1 (Mehdi.Alouini@univ-rennes1.fr)

Deadline to apply: May 31, 2016