

# PhD Offer

## Ultra-Fast Reconfigurable Antenna Arrays Using Vanadium Dioxide (VO<sub>2</sub>)

- **Key words**

Reconfigurable antennas arrays, phased arrays, reflectarrays, Vanadium dioxide, optical reconfiguration.

- **Context and overview of the problem**

Next-generation communication / security / surveillance / sensing systems for civilian, defense space or airborne applications will require real-time ultra-fast self-reconfigurable operations to efficiently optimize their performances (data rate, quality of service, resolution, etc.). In particular, reconfigurable antenna arrays (which present the capability to modify working frequency, bandwidth and/or radiation pattern) are becoming a key challenge for the next ten years. They are often based on semiconductors, MEMS or tunable materials. These methods suffer from limited switching time and interactions between the RF and DC bias signals. On the opposite, optical reconfiguration enables to separate steering and microwave (MW) signals, increasing the complexity of the antenna architecture but decreasing the design constraints on the MW parts and their integration. Different solutions have been developed based on organic materials to fabricate phototransistors or photoswitches, or inorganic ones such as Vanadium dioxide (VO<sub>2</sub>). VO<sub>2</sub> offers an extremely promising and emerging new technology to fabricate ultra-fast switches with high-isolation over a very broad frequency band, and high contrast between the on/off states. In this context, IETR and TE-OX aim at demonstrating the interests of VO<sub>2</sub> to design for the first time VO<sub>2</sub>-based reconfigurable antenna arrays by developing relevant proofs-of-concepts of ultra-fast reconfigurable microwave phased array antenna, and by exploring an advanced concept of optically-controlled reflectarray.

The proposed PhD thesis will be carried out in the frame of a collaborative research project between the IETR laboratory ([www.ietr.fr](http://www.ietr.fr)) and the emergent TE-OX SME, funded by the French Research and Technology National Association (ANRT, [www.anrt.asso.fr](http://www.anrt.asso.fr)), through a CIFRE agreement.

- **Description of work**

The aim of this PhD project is to design, optimize, prototype and characterize reconfigurable phased array antenna and advanced reflectarray using optically controlled VO<sub>2</sub> materials. The thesis is organized into three main steps:

- Detailed bibliography study on phased arrays and reflectarray antennas, and on Metal Insulating phase Transition (MIT) materials such as VO<sub>2</sub>.
- Study of a reconfigurable phased array antenna using VO<sub>2</sub> materials (array design, study of the integration of VO<sub>2</sub> and of the actuation system, etc.).
- Study of an advanced optically reconfigurable reflectarray.

- **Candidate profile**

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

- **How to apply?**

Motivated candidate should send by email 1) a detailed CV, 2) a motivation letter, 3) a recommendation letter and 4) marks obtained over the last 3 years, to Erwan FOURN ([erwan.fourn@insa-rennes.fr](mailto:erwan.fourn@insa-rennes.fr)), to Ronan SAULEAU ([Ronan.Sauleau@univ-rennes1.fr](mailto:Ronan.Sauleau@univ-rennes1.fr)), and Guy GARRY ([guy.garry@te-ox.com](mailto:guy.garry@te-ox.com)).

**Deadline to apply: May 31, 2016**