

THz semiconducting oxide detectors and arrays

CentraleSupélec + MVG Industries SAS



NICOLAS BAUDIN
INTERNSHIPS IN FRANCE INITIATIVE

Name of the hosting institution in France	CentraleSupélec
Name of the host laboratory / research team	Group of Electrical Engineering – Paris (GeePs)
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Internship offer

Topic of the internship (title) THz semiconducting oxide detectors and arrays

Proposed dates of the internship **Start:** 2019-09-01 **End** 2020-01-31

Scientific and academic objectives of the internship (detailed description of the internship content, work expected from the intern and expected outcomes):

Terahertz (THz) electromagnetic waves, ranging from 500 GHz to 5,000 GHz (= 5 THz) frequencies, provide many fields of imaging applications (industrial control, biomedical, life science, etc.). They also offer a great interest in fundamental research (astrophysics, condensed matter physics, spectro-chemistry), because of the many atoms, ions, radicals, molecules, that exhibit specific frequencies in the THz domain. THz imaging applications require good sensitivity and reasonable cost. In this context, we wish to investigate detector arrays based on the amorphous Y-Ba-Cu-O semiconducting phase, operating at room temperature and exploiting the pyroelectric principle (i.e. a thermal sensor, thus with broad spectral range). Y-Ba-Cu-O (better known as a superconductor) has, in its semiconducting form, a thermal sensitivity much higher than those of other materials used in imaging applications (see papers in *Thin Solid Films* 601, pp. 93-98 (2016), and 617, pp. 71-75 (2016); see also mdmi.lgep.supelec.fr).

In this research project, the candidate will initially characterize single pixel sensors in the infrared (IR), to optimize their operating conditions. In a second step, the migration from IR to THz will be considered by: i) studying the coupling with a planar antenna (with the advice of our industrial partner MVG Industries SAS, well established in Europe, USA, and Asia, www.mvg-world.com); ii) implementing a test facility using coherent or incoherent sources. Finally, small arrays (e.g. 4x4 size) of detectors will be investigated together with their integration in self-contained packages. The expected outcome is to bring the Technology Readiness Level of detector arrays from TRL3 (analytical and experimental proof of concept) to TRL4 (component validation in laboratory environment).

Name of industrial partner	MVG Industries SAS
Role of the industrial partner in the internship project	Advice in pixel coupling with a planar THz antenna.
Main contact at the French industrial partner	Mr. Luc DUCHESNE, R&D Director
Targeted Australian university	Any

Expected profile of applicant

Level of study	Ongoing Master of Science
Discipline	Electrical Engineering or Photonics or Applied Physics
Required qualities, knowledge and skills	Affinity to combine conceptual aspects with experimental aspects.
Other specific eligibility criteria	Australian citizenship, Commonwealth Countries citizenship.

