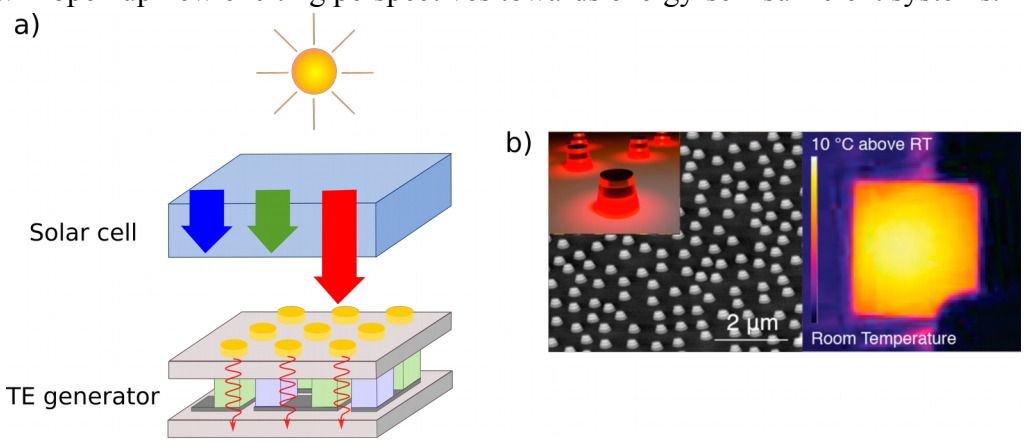
PhD position at LAAS-CNRS on nanoantennas-enhanced photovoltaic-thermoelectric cogeneration systems

A 3-year PhD position in Physics is available in the Photonics group at LAAS-CNRS, Toulouse, France in close collaboration with the Department of Physics, University of Gothenburg, Sweden.

Background: As the conversion efficiencies of mature photovoltaic technologies keep on increasing, they are getting closer to the theoretical limit of 33% for a single-junction solar cell. Strikingly, up to 50% of the incident solar energy is still lost or dissipated as heat into the photovoltaic cell. An original approach to recover this lost energy and thus exceed the maximum efficiency for single-junction solar cells is to integrate the solar cell into a photovoltaic-thermoelectric (PV-TE) cogeneration system. In order to demonstrate a breakthrough in the conversion efficiency of the PV-TE system, we propose a novel approach based on introducing thermoplasmonic nanoantennas between the solar cell and the thermoelectric generator (Fig.a). These nanoantennas will be converting the infrared photons that are not absorbed in the solar cell into heat to boost the efficiency of the thermoelectric generator (Fig.b). The advances made in this project will open up new exciting perspectives towards energy-self-sufficient systems.



Purpose of the project: The goal of the PhD will be to realize the first experimental demonstration of a PV-TE system integrating thermoplasmonic nanoantennas with tailored optical and thermal properties. The prospective PhD student will work on the electromagnetic design of the nanoantennas as well as their nanofabrication and integration onto thermoelectric generators to make a proof-of-concept demonstrator. The PhD student will benefit from the scientific environment provided at the Laboratory of Analysis and Architecture of Systems, a multidisciplinary research lab of CNRS located in Toulouse, France, with access to state-of-the-art clean room equipment and excellent doctoral training. The PhD is in the framework of close collaboration in PV-TE cogeneration systems between LAAS-CNRS and the Department of Physics, University of Gothenburg, Sweden (Prof. Alexandre Dmitriev). The PhD student will thus have strong interactions with Prof. Dmitriev's group and benefit from their state-of-the-art expertise in the design and fabrication of multifunctional plasmonic nanoantennas and the excellent research facilities of Gothenburg Physics Center.

Techniques: The candidate will learn numerical simulation methods and various lithography techniques for micro- and nano- fabrication. He/she will use several clean room characterization tools (e.g. SEM, AFM, ellipsometry) as well as dedicated optical and electrical characterization setups. He/she will also get full training on standard clean-room techniques.

Application: Candidates are invited to apply until 30th April 2020 by sending a letter of motivation, a detailed CV and the contact details of three referees. PhD candidates must hold an MSc degree in Physics or Materials Science. The applications should be submitted by e-mail to Dr. Inès Massiot, massiot@laas.fr