



PhD Position 2015
(IETR, Rennes, France)

MILLIMETER-WAVE TECHNOLOGIES FOR BIOMEDICAL ELECTROMAGNETICS

- **Key words**

Electromagnetic exposimetry, 30-100 GHz range, electromagnetic / thermal co-modeling, thermal pulses, heat focusing.

- **Context**

Millimeter-wave (MMW) technologies are increasingly used for various applications. In particular, they have been used for high data rate communications [> 5 Gb/s] and 60-GHz technologies are expected to be integrated in the near future in the next generation mobile systems. Besides, it was suggested that MMW can be used for a number of biomedical applications, including remote monitoring of wounds and non-invasive detection of glucose levels. Recently, our research team has demonstrated the possibility of selective focusing of heating in cutaneous and sub-cutaneous layers by means of MMW for thermal treatments. This opens a door to new potential applications of MMW in the field of biomedical electromagnetics, including selective targeting of skin cancers.

- **Objectives**

The main purpose of this PhD research project is to explore the potential of MMW for innovative applications in the field of biomedical electromagnetics.

- **Work description**

The PhD student will work at the Institute of Electronics and Telecommunications of Rennes (IETR), UMR CNRS 6164, Rennes, France. The guidelines of the PhD project are threefold:

1. To explore the potential of the 30-100 GHz range for selective non-invasive high-resolution focusing of heat within human skin and sub-cutaneous layers based on the recent advances of the IETR in the field. This work will include numerical analysis of the electromagnetic field propagation / absorption and heating in the body, measurements using tissue-equivalent phantoms, design of radiating structures for the near-field focusing of the electromagnetic energy.
2. To develop a dosimetric methodology for accurate control of exposure and local heating applied to pulse-modulated MMW radiations. A unique experimental tool recently developed by the IETR and able to generate short thermal pulses with the peak amplitude of several tens of °C will be used in this part of the study.
3. Finally previously developed methodologies and approaches will be used for selective targeting of cancer cells and tissues. This part of the study will be carried out in a close collaboration with experts from French Institute for Research on Environmental and Occupational Health (IRSET) and Institute of Cell Biophysics (ICB).

- **Candidate**

Education: MS or equivalent. *Background:* electromagnetics, numerical modeling, antenna design, microwave / MMW measurements. Knowledge in biology / biophysics is welcome but not mandatory.

- **Funding**

PhD fellowship from French "Ministère de l'Enseignement Supérieur et de la Recherche (MESR)".

- **Contacts**

To apply please provide your CV, motivation letter, and reference letters (optional) before May 31, 2015 to:

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