

PhD offer for FET-Open European Project PrimoGAIA

Title : Development of pre-polarization for molecular MRI at ultra-low magnetic field

Context of the subject: Le Centre de Résonance Magnétique des Systèmes Biologiques is the driving force behind a European FET-open project (Future Emerging Technologies).

The aim of the PrimoGaia project (Pr: prepolarized; imo: molecular imaging; Gaia: earth field) is to open a new path in the field of Magnetic Resonance Imaging (MRI) by initiating the concept of "enzymatic imaging" *in vivo* for a better understanding of human physiology, early detection and prognosis of diseases, monitoring of therapeutic treatments.

The main objective is to go beyond the current boundaries of MRI by mapping and quantifying the activity of an enzyme in a diseased tissue.

It will be carried out by **building a new MRI instrumentation operating in Low and Earth's magnetic fields to allow the use of a frequencies in the Radio Frequency domain (1 to 200MHz)** to saturate the transition of the Electronic Paramagnetic Resonance (EPR) of the Nitroxyl radicals. When the radical EPR resonance is saturated, the polarization is transferred to the protons of the water molecules (Overhauser MRI). The improvement factor can reach more than two orders of magnitude. The polarized water signal therefore indicates the local concentration of radicals that reflect enzymatic activity.

The overall methodology will be much less expensive than current clinical scanners and will allow distribution in developing countries. PrimoGaia brings together an interdisciplinary consortium of research teams from 4 universities: CNRS Bordeaux and Marseille (France), U Mons (Belgium), U Torino (Italy), Fraunhofer (Germany) and 2 companies: "Stelar" (Italy) and "Pure Device" an innovative SME (Germany).

Thesis subject: The precise objective of the thesis project is to develop the dynamic pre-polarization sub-unit that can be used in low or Earth's magnetic field. This sub-unit, consisting of an amplifier chain and an antenna(s), will provide polarization transfer between the free radical and the water proton.

The thesis project is part of an interdisciplinary project involving instrumentalist physicists and contrast agent chemists

Candidate's profile: We are looking for a motivated candidate with a background as a physicist / electronics engineer in the field of Engineering Sciences with an interest in the biological and medical applications of NMR. Knowledge in physics, electronics and Radio-Frequency domain is essential, an interest in the basic physics of NMR is desirable. An experience in software simulations (Physics/RF-domain) will be a positive point.

Given the European context of the project, knowledge of written and spoken English is essential. The candidate will have to interact with the various project partners and travel to the different sites and countries.

Additional information: The candidate will integrate a stimulating environment. He will be an integral part of the CRMSB's Instrumental and Methodological Development MRI team. He/she will have all the tools necessary for the smooth running of his/her project and will have access to a wide range of MRI instruments.



The thesis will be funded by FET Open Europe for a period of 3 years, starting in January and will be supervised by **Pr JM Franconi (project PI)**. He / she will be recruited by the CNRS, and will be part of the ED doctoral school of Bordeaux University. CNRS has the label HR Excellence for research (HRS4R) and promotes transparency of the recruitment process and equal opportunities.

Contact : A CV and a cover letter should be sent to JM Franconi (franconi@rmsb.u-bordeaux.fr), Philippe Massot (massot@rmsb.u-bordeaux.fr) and Sylvain Miraux (miraux@rmsb.u-bordeaux.fr)