Master or semester project

Novel hardware technologies for neuroimaging and neurostimulation

In our laboratory, we develop innovative hardware concepts for magnetic resonance imaging (MRI), in particular ultra-high field MRI ($B_0 \geq 7$ T). We focus on unconventional transmit and receive radio frequency (RF) coil arrays involving strategies such as dipole antennas, dielectric resonators and flexible loop coils. We aim to substantially boost receive sensitivity in neuroimaging, and thereby accelerate total scan time and increase spatial resolution. In addition, we explore other advanced, MRI-based techniques, which can provide unique insights into metabolism and function of the brain, such as phosphorus (^{31}P) MR spectroscopy and electroencephalography combined with functional MRI (EEG/fMRI). Furthermore, we also actively work on highly promising strategies for non-invasive human brain stimulation. In particular, we develop hybrid hardware systems enabling transcranial low-intensity focused ultrasound (LIFU) neuromodulation combined with UHF-MRI, aiming at finding new ways to treat neurological and neuropsychiatric diseases
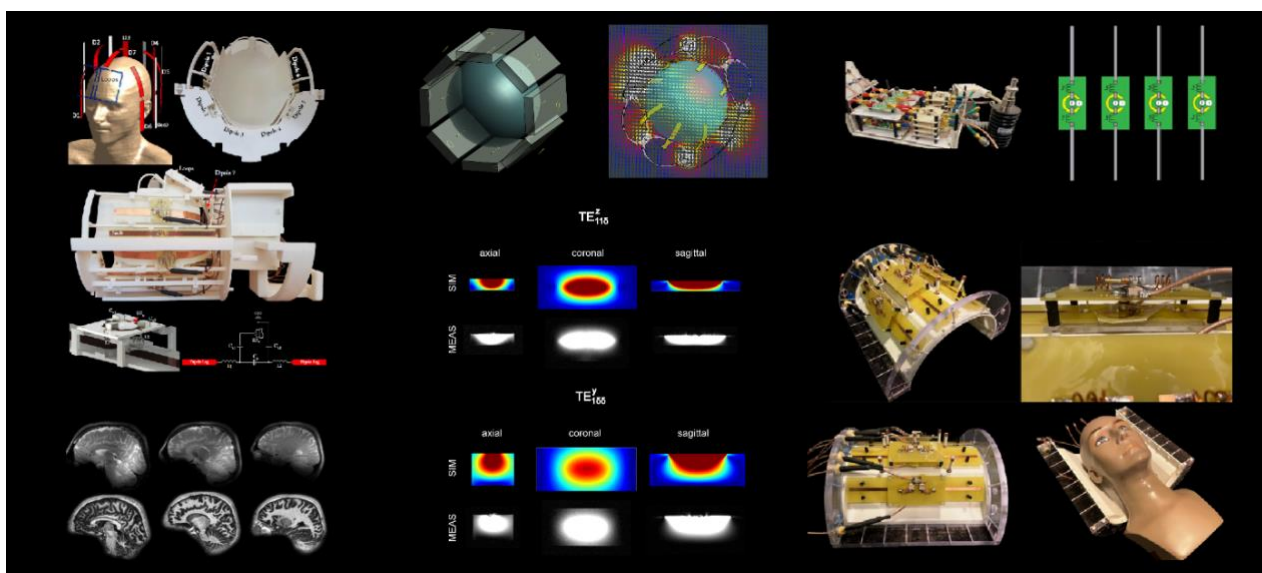
Projects of interest are:

- **Radio frequency arrays for neuro applications at 7T:**
    - Neuroimaging
    - Simultaneous EEG/fMRI
    - ^{31}P MRI and MR spectroscopy
- **Hybrid systems for low-intensity focused ultrasound neuromodulation and UHF-MRI**

Requirements

We are looking for motivated students who would like to contribute to our research projects. Ideally, you have a background in physics / medical physics / electrical engineering / biomedical engineering or related field.

Responsibilities

You would be involved in solving tasks linked to:

- RF coil design, construction and evaluation using a network analyzer
- Numerical simulations (electromagnetic, acoustic and thermal)
- MRI RF pulse sequence testing and MRI phantom experiments at 7T
- Experimental ultrasonic beam mapping & development of algorithms for ultrasound targeting
- Data processing and analysis

Surervisor

- Dr. Daniel Wenz, Research staff scientist, CIBM MRI EPFL Section
- Prof. Dimitri Van De Ville, Head, CIBM MRI EPFL Section

How to apply: if you are interested to learn more about the projects, please contact: daniel.wenz@epfl.ch

About CIBM

The CIBM Center for Biomedical Imaging was founded in 2004 and is the result of a major research and teaching initiative of the partners in the Science-Vie-Société (SVS) project between the Ecole Polytechnique Fédérale de Lausanne (EPFL), the Université de Lausanne (UNIL), Université de Genève (UNIGE), the Hôpitaux Universitaires de Genève (HUG) and the Centre Hospitalier Universitaire Vaudois (CHUV), with the generous support from the Fondation Leenaards and Fondation Louis-Jeantet.
CIBM brings together highly qualified, diverse, complementary and multidisciplinary groups of people with common interest in biomedical imaging.

We welcome you in joining the CIBM Community.

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