

Multi-echo fMRI: basics, denoising, and applications to neuroscience

Organizers:

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ME-fMRI has been shown to increase BOLD sensitivity compared to regular single echo fMRI. ME-NMR signal decay models can be used to validate BOLD signals at the subject-level and identify a wide variety of non-BOLD artifacts for denoising - greatly decreasing confounds from artifacts and biases from preprocessing.

We propose a course that will enable participants to use this new methodology and highlight the new domains of study that are now possible. This topic is timely since subject-level fMRI and the study of brain dynamics are emerging as new frontiers; these and many other applications require higher fMRI signal fidelity than is afforded by currently standard techniques. Thus, this course will be of considerable interest to a wide range of researchers.

Participants will learn about basic ME acquisition and theory as well as advanced acquisition using the novel multi-band (MBME) technique with comparisons to state-of-the-art fMRI acquisition across field strengths (Poser), ME-ICA denoising strategies (Kundu, Evans), and practical guidance for translational applications (Lombardo, Voon).

They will also learn about the benefits and limitations of using ME-ICA denoised data including: improvements of statistical power and effect size (Lombardo), detection of ultraslow BOLD and their validation by ME-fMRI-EEG (Evans), enhancement of the sensitivity of graph theory metrics and increased functional specificity of small subcortical structures in translational studies, (Voon), and applications to studying neurodevelopment in drug-administration contexts (Lombardo).

Next to their specific applications, lecturers will take care to provide a balanced overview of published applications of ME-fMRI in human and animal imaging.

Symposia Schedule:

8:00-8:12

Multi-echo basics

Benedikt A. Poser, Department of Cognitive Neuroscience, Maastricht University, Maastricht, Netherlands

8:12-8:24

ME-ICA denoising

Prantik Kundu, PhD, Icahn School of Medicine at Mt. Sinai, New York, NY, United States

8:24-8:36

Differentiating slow BOLD changes from baseline drifts

Jen Evans, NIH, Bethesda, MD, United States

8:36-8:48

Statistical power improvements using ME-ICA applied to neurodevelopmental disorders

Michael Lombardo, Psychology Department, University of Cyprus, Cyprus

8:48-9:00

Enhanced sensitivity of ME-ICA for translational applications

Valerie Voon, University of Cambridge, Cambridge, United Kingdom

9:00-9:15

Questions and Answers