

Multi-Echo fMRI and its Applications in Neuroscience and Neuropsychiatry

Organizers:

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We propose a session to present the new domains of fMRI study that are enabled by multi-echo fMRI (ME-fMRI), spanning functional brain organization, activation dynamics, and neuropsychiatric conditions such as addiction and impulsivity. Multi-echo fMRI has been shown to increase BOLD sensitivity compared to regular single echo fMRI and become popular at many labs. Furthermore, with ME-fMRI, NMR signal decay models can be used to validate BOLD signals at subject-level and identify a wide variety of non-BOLD artifacts for denoising - greatly decreasing confounds from artifacts and biases from preprocessing. This topic is timely since subject-level fMRI and the study of brain dynamics are emerging as new frontiers, and these and many other applications require higher fMRI signal fidelity than is afforded by currently standard techniques. The presentations in this educational session will cover a wide array of topics, from implementation of advanced ME acquisition and analysis strategies (Poser, Evans), the novel multiband multi-echo (MBME) technique and how it compares to state of the art fMRI acquisition protocols across field strengths (Boyacioglu), subcortical-cortical connectivity in impulsivity disorders (Voon), typical brain development, and ultraslow BOLD phenomena and cross-referenced to ME-fMRI-EEG (Evans). Next to their specific applications, the lecturers will take care to provide a balanced overview of published applications of multi-echo fMRI in human and animal imaging.

Multi-echo basics

Benedikt Poser, Maastricht University, Maastricht, Netherlands

Methods and Applications of Multi-band Multi-echo fMRI

Prantik Kundu, Icahn School of Medicine at Mount Sinai, Manhattan, New York, United States

Differentiating slow BOLD changes from baseline drifts

Jennifer Evans, NIH, Bethesda, MD, United States

Sub-cortical connectivity

Laurel Morris, University of Cambridge, United Kingdom