MEG functional connectivity to disclose frequency specific interactions in the resting brain

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ABSTRACT

In the last decade, neuroscience has seen a paradigm shift from a modular view, in which different functional units act as independent processors, to a large-scale network view, in which dynamic interactions between brain areas are crucial for cognition and behavior (Bressler and Menon, 2010). While functional magnetic resonance studies have been seminal in this regard (Fox and Raichle, 2007), non-invasive electrophysiology has contributed to this view by the characterization of neuronal networks in terms of their oscillatory fingerprints (Brookes et al., 2011; de Pasquale et al., 2010; Engel et al., 2013; Ganzetti and Mantini, 2013; Mantini et al., 2007; Marzetti et al., 2013).

In this talk, I will review different approaches used to assess source-based MEG functional connectivity at different temporal scales. I will then focus on methods to detect phase coupling of neuronal oscillations and present new methodological developments, namely multivariate methods for functional connectivity, that allow a more robust detection of frequency-specific resting state networks with MEG. Specifically, I will present results from the MEG Human Connectome Project in relatively large cohort of 65 healthy participants that clearly show the benefit of multivariate functional connectivity methods and allow to detect a network of directed interactions between the primary visual cortex and the rest of the brain in the alpha frequency band.