**Titolo:** Mathematical tools for decision making modeling from M/EEG data: from source localization to functional connectivity estimation

**Relatrice:** Sara Sommariva (Dipartimento di Matematica, Università degli studi di Genova)

**Talk parte del simposio:** SIMPOSIO GIOVANI IV - The developing nature of decision-making dynamics: from models to neural signals

Many studies have shown that primate decision-making mechanisms rely on complex brain networks that regulate a dynamic two-stage algorithm consisting first in a valuation of the possible options and then in an actual choice [1]. While so far most of these studies have been conducted on the monkey brian using either invasive measurements or functional Magnetic Resonance Imaging (fMRI), Magnetoencephalography (MEG) and electroencephalography (EEG) thanks to their non-invasiveness and high temporal resolution may play a crucial role in disentangle the same mechanisms in the human brain.
However, the study of brain network dynamics from MEG/EEG data is a complex mathematical problem. Brain networks are typically estimated from the recorded data with a two-step approach designed to reduce the effects of volume conduction. More in detail, first the brain activity generating the recorded data is estimated by solving the so called MEG/EEG inverse problem, which results to be ill-posed and highly undetermined. Then connectivity metrics are designed and computed in order to quantify the statistical relationships among the activity reconstructed in different and spatially distant brain areas.
The first part of this talk will be devoted to reviewing some of the most commonly employed connectivity metrics and mathematical methods for solving the MEG/EEG inverse problems. Afterwards, some more recent methods developed in our lab will be presented [2,3] to study brain connectivity in the frequency domain in order to characterize the interplay between and within different brain rhythms.

References

1. Kable, Joseph W., and Paul W. Glimcher. "The neurobiology of decision: consensus and controversy." Neuron 63.6 (2009): 733-745.
2. Vallarino, Elisabetta, et al. "Transfreq: A Python package for computing the theta-to-alpha transition frequency from resting state electroencephalographic data." Human brain mapping (in press).
3. Amerighi, Martina, etl al. “Sparse regularization for estimating the cross-power spectrum in linear inverse models” (in preparation)