Seminar title:
Electroencephalographic signal processing: the use of Independent Component Analysis and its application to complex motor task.

Simona Lanzafame
University of Messina, Department of Matter Physics and Electronic Engineering.
The City College of New York, CUNY, Sophie Davis School of Medicine.

Abstract
Electroencephalographic (EEG) signal obtained from scalp electrodes is a sum of the large number of neurons potentials. The interest of the scientific community is in studying the potentials in the sources inside the brain and not only the potentials on the scalp, which globally describe the brain activity.
The recovery of the exact cortical distribution of an EEG source region is limited by the unsolved of the inverse source localization problem. For example, far-field potentials from two synchronously active but physically opposing cortical source areas – e.g., source areas facing each other on opposite sides of a cortical sulcus – may cancel and their joint activity will have no effect on the scalp data.
An ideal goal for EEG analysis should be to detect and separate activities in multiple concurrently active EEG source areas, regardless of their relative straights at different moments.
A new approach to finding EEG source activities has been developed based in a simple physiological assumption that across sufficient time, the EEG signals arising in different cortical source domains are temporally independent of each other. This means that measuring the scalp EEG activity produced in some of the source domains at a given moment allows no inferences about EEG activities in the other source domains at the same instant. This insight and the resulting algorithms for signal separation that have emerged in the last decade have created a new field within signal processing in general, known in particular as independent component analysis (ICA).
We will discuss the important findings obtained by a novel application of the ICA algorithm to complex motor task.