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**ONLINE SEMINAR BY PROF. MICHELE ALLEGRA**  
(Department of Physics and Astronomy - Padova)  
**March 3rd, 2022 - 3:00 p.m.**

Zoom link: <https://bit.ly/3s4UCzW>

**Title of the seminar:** Approaches to brain controllability

**Abstract:** A major goal of applied neuroscience is to understand how to achieve controlled perturbations of brain activity through stimulation or brain-computer interfaces with the aim of investigating brain mechanisms or restoring normal activity patterns in subjects affected by neuropathologies.

In recent years, several authors have proposed to frame this problem within control theory, a well established engineering paradigm to control dynamical systems. In this framework, a model of the autonomous (uncontrolled) dynamics of the system is used to precisely devise external interventions that, in combination with the autonomous dynamics, will steer the system towards desired targets. Three main obstacles, however, hinder the applicability of control theory to the brain: (1) a limited ability to measure or reconstruct intrinsic dynamics (2) a difficulty in realizing targeted perturbations (3) the complexity (high dimensionality) of the system. In this seminar, we shall illustrate these problems, focusing on our recent theoretical investigations of brain controllability in humans, where intrinsic brain dynamics can be characterized through neuroimaging (fMRI). We shall argue that achieving precise control of whole-brain activity by a naive application of standard control theory is currently unfeasible. Finally, we shall briefly discuss possible alternatives to realize controlled manipulations of global brain activity.