UNIVERSITÀ
CAMPUS BIO-MEDICO
DI ROMA

Facoltà Dipartimentale di Medicina e Chirurgia

Unità di Ricerca Neurophysiology and Neuroengineering of the Human-Technology Interaction- NeXTLab,

TMS-EEG: Probing Cortical State with i-TEPs

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Short Bio

Leo Tomasevic is a neuroscientist and postdoctoral researcher at the Department of Psychiatry and Psychotherapy at the University of Regensburg, and the Department of Human Sciences, Institute of Psychology at the University of the Bundeswehr Munich, Germany. After graduating in Electronic Engineering from the University La Sapienza in Rome, he earned a PhD in Computing and Mathematics from the University of Plymouth (UK), while working at the Institute for Cognitive Sciences and Technologies at the Italian National Research Council (ISTC-CNR). Before moving to Germany, he was a postdoctoral researcher and EEG group leader at the Danish Research Centre for Magnetic Resonance (DRCMR) at Copenhagen University Hospital Hvidovre. Leo's research focuses on the activity and interaction of primary sensory and motor areas, the balance between excitation and inhibition within these systems, and the role of brain rhythms in shaping cortical dynamics. He applies multimodal approaches, combining, for example, EEG and TMS, to investigate how the brain processes, integrates, and adapts sensorimotor information. He served as principal investigator on a Lundbeck Foundation-funded project investigating GABAergic inhibition in the human cortex.

Abstract

What is the brain doing right now, and how can we measure it? In this talk, I present a physiologically grounded approach that combines transcranial magnetic stimulation (TMS) with EEG to probe the instantaneous state of the human cortex with millisecond precision. I introduce i-TEPs, immediate TMS-evoked potentials occurring just 2–5 ms after stimulation, as a direct, local marker of cortical reactivity. These ultra-early responses bypass sensory reafference and network reverberation, offering a clean window into local excitation/inhibition balance, GABAergic tone, and microcircuit dynamics. Building on this, I show that both i-TEPs and MEPs are strongly modulated by the phase of the ongoing sensorimotor mu-rhythm at the moment of stimulation. These findings reveal how spontaneous brain rhythms gate cortical responsiveness, with implications for state-dependent stimulation, closed-loop neuromodulation, and precision neurophysiology.

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