

Abstract

The brain is a physical system whose structures and dynamics extend over many orders of magnitude in space and time, as do measurement and imaging methods. By averaging over scales of a few tenths of a millimeter and below, physics-based neural field theory (NFT) enables a unified treatment of brain activity and structure from the millimeter scale up to the whole brain, and from milliseconds to days and beyond.

This talk outlines the basis of NFT and how it is used to explain brain function and structure. In particular, it explains phenomena such as natural brain resonances, the effects of external stimuli, epileptic seizures, and sleep-wake dynamics. Links to underlying brain structure and physiology can also be inferred by fitting NFT predictions to data, and brain states can be tracked. A recently published, publicly available NFT simulation code is also introduced, which enables researchers to carry out NFT computations conveniently, thereby opening up many directions for further research.