



**POLITECNICO
DI TORINO**

Dipartimento
di Ingegneria Meccanica
e Aerospaziale

SEMINAR

FRIDAY 13 SEPTEMBER 2019

DO CONSCIOUSNESS, ANESTHETIC ACTION AND EEG ALL DERIVE FROM QUANTUM VI- BRATIONS IN MICROTUBULES?



**Prof. Stuart Hameroff,
Director Center for Consciousness Studies
Department of Anesthesiology - University of Arizona**

II FLOOR –FERRARI ROOM

Electro-encephalography (EEG) has been clinically used for 100 years, and gamma synchrony EEG (30 to 90 hertz) correlates well with consciousness. Yet the origin, brain-wide coherence and underlying significance of gamma synchrony and other EEG rhythms remain unknown. A theory of consciousness needs to account for its correlates, including EEG and the action of anesthetic gases which selectively prevent consciousness and gamma synchrony, sparing non-conscious brain activities. The Penrose-Hameroff Orch OR theory does so by proposing that consciousness derives from orchestrated ('Orch') quantum vibrations in microtubules, self-assembling polymers of the protein tubulin inside neurons. The quantum vibrational states are proposed to reach threshold for 'objective reduction' ('OR') at which a moment of consciousness occurs, sequences of which give a stream of consciousness. In support of Orch OR, quantum vibrations in tubulin and microtubules in frequencies ranging through terahertz, gigahertz, megahertz and kilohertz have been detected. Further, it appears that anesthetic gases specifically dampen terahertz quantum vibrations in tubulin to prevent consciousness. Regarding EEG, microtubules in neuronal dendrites and soma are uniquely arrayed in mixed polarity networks, such that energies and vibrational frequencies among adjacent (but oppositely oriented) microtubules in a constant external field will differ slightly. Orch OR suggests negative resonance due to interference effects from slightly off-set microtubule quantum vibrations to give slower beat frequencies extending to gamma synchrony and other EEG rhythms. Consciousness (by Orch OR) may occur holographically due to interference in a multi-scale brain hierarchy, ranging upward from terahertz in tubulin through gigahertz, megahertz, kilohertz and hertz (EEG) processes in microtubules, microtubule arrays, neurons and small-world neuronal networks. Thus quantum terahertz vibrations in brain microtubules can account for consciousness, the action of anesthetic gases, and the origin of EEG.

dendrites
cell body

syn

Axon

Fire

Gap