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Quantum Information Processes in Protein Microtubules of Brain Neurons

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We study biologically ‘orchestrated’ coherent quantum processes in collections of protein microtubules of brain neurons, which correlate with, and regulate, neuronal synaptic and membrane activity. In this situation the continuous Schrodinger evolution of each such process terminates in accordance with the specific Diosi–Penrose (DP) scheme of ‘objective reduction’ (‘OR’) of the quantum state. This orchestrated OR activity (‘Orch OR’) is taken to result in moments of conscious awareness and/or choice. We analyze Orch OR in light of advances and developments in quantum physics, computational neuroscience and quantum biology. Much attention is also devoted to the ‘beat frequencies’ of faster microtubule vibrations as a possible source of the observed electroencephalographic (‘EEG’) correlates of consciousness.