

Quantum Version of Plonsey (1967): a Proposal

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Abstract

In this note the authors propose a novel approach to the quasistationarity conditions for physiological systems.

In [1], the authors derive the conditions under which the electric and magnetic settings within physiological systems can be taken to be quasistationary. They use the Helmholtz equations to do so.

These authors do not consider what happens in the near-field zone [2], to the electric and magnetic field. In this zone, quantum electrodynamics effects might become important. Studies of ion channel electrodynamics [3] may require knowledge of the near-field. We therefore propose a fully quantum mechanical derivation of the Plonsey paper and its comparison with the classical results.

References

- [1] Robert Plonsey and Dennis B. Heppner. Considerations of quasi-stationarity in electrophysiological systems. 29:657.
- [2] Ole Keller. Attached and radiated electromagnetic fields of an electric point dipole. 16(5).
- [3] Aman Chawla. *On Axon-Axon Interaction via Currents and Fields*. PhD thesis, University of South Florida, 2017.