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脑科学与量子理论

邱锡钧

上海大学理学院物理系,上海200444

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摘要

简要回顾了生物学与物理学之间的紧密关系，其中包括人工神经网络的经典物理模型和脑的某些量子理论；概要综述了细胞骨架微管的结构和生物功能及有关近期理论研究。注意到微声是细胞和神经元中重要的组成和功能单元，进而以较大篇幅介绍了近期关于微管的理论研究工作，特别是基于量子场论中两能级系统的赝自旋模型，对微管管壁上电子的动力学行为作了较深入的探讨；此外，基于量子场论，对微管中的水分子系统可能存在微波受激辐射也作了阐述。

The present paper briefly reviews the relationship between biology and physics, especially including the classical physics models for the artificial neuron networks, some quantum theories for brains, and simply describes the structures and functions of cytoskeletal microtubules （MTs） in cells and some recent theoretical studies on MTs.Noting MTs are the important components and function units in cells and neurons, furthermore, the paper lays emphasis on our recent theoretical work on MTs. Particularly, based on the pseudo-spin quantum theory, the dynamic behavior of electrons on the MT wall has been discussed in some detail. Based on the quantum field theory, it has been described that the maser radiation might exist in the water molecular system within the MT.

关键词 脑科学 细胞骨架微管 量子理论 赝自旋模型 电磁集体辐射

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DOI:

通讯作者:

作者个人主页: 邱锡钧