

Allgemeines Physikalisches Kolloquium

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Computing with physics: Biological and bio-inspired intelligence

Whether biological or artificial, intelligence ultimately boils down to the ability of physical substrates to perform (complex) computations efficiently. Understanding intelligence thus requires overcoming a set of interrelated - and interdisciplinary - challenges. As computational neuroscientists, we need to figure out which aspects of biological dynamics are relevant for information processing. As physicists, we need to build appropriate theories and models thereof. As computer scientists, we need to understand which algorithms can "run" on such dynamics. And as engineers, we seek to build devices that emulate them efficiently.

Originally, artificial intelligence was clearly inspired by the brain, but has since diverged away... Or has it? In offering some answers to the grand challenges above, I will address the AI revolution, and how it interacts with modern neuroscience and neuromorphic technology, both as benefactor and beneficiary. In particular, I will address a series of interconnected questions. How can cortical networks, bound by spatiotemporal locality constraints, learn to solve complex problems in the first place? How can they do so using spikes - the universal information carriers in the mammalian brain? And how can we efficiently emulate such neuro-synaptic dynamics in silico?