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Quantum statistical mechanics of the SYK model, charged black holes, and strange metals

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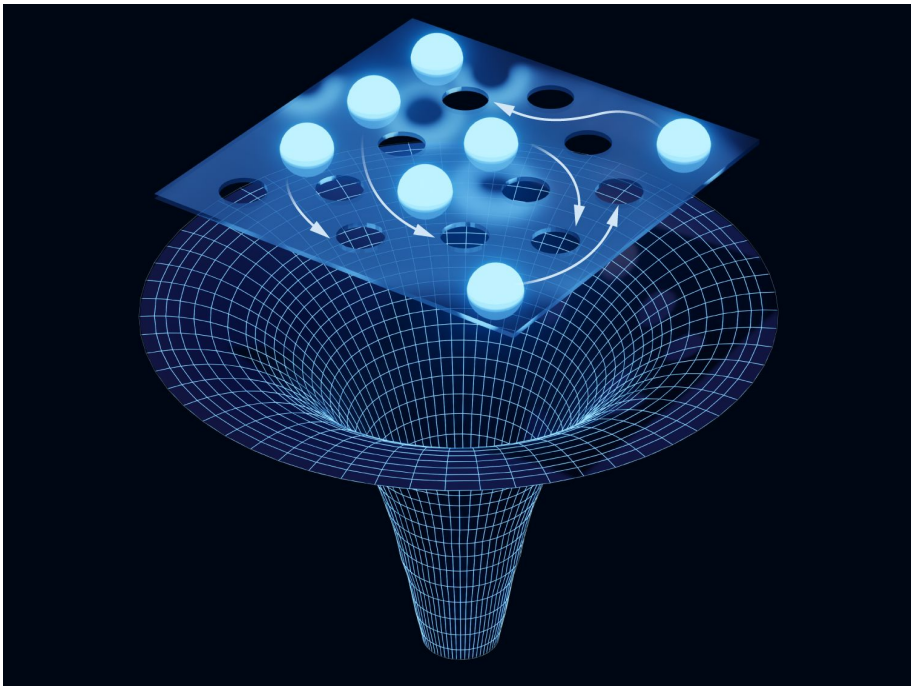
Author introduction

Subir Sachdev is the Herchel Smith Professor of Physics at Harvard University. He has been elected to national academies of science in India, United States, and England. He is a recipient of several awards, including the Dirac Medal from the International Centre for Theoretical Physics, and the Lars Onsager Prize from the American Physical Society. Sachdev's research describes the connection between the observable properties of matter and many-particle quantum entanglement. Some of this work is described in the books *Quantum Phase Transitions* and *Quantum Phases of Matter*. The Sachdev-Ye-Kitaev model of many-particle entanglement has led to new insights on high temperature superconductivity in the copper-oxide compounds. The SYK model has also led to an understanding of how black holes with a net electrical charge realize Hawking's black hole entropy in a manner consistent with the principles of quantum mechanics.



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Abstract The Sachdev-Ye-Kitaev model provides a solvable theory of entangled many-particle quantum states without quasiparticle excitations. I will describe how its solution has led to an understanding of the universal structure of the low energy density of states of charged black holes, and to realistic and universal models of strange metals.

Keywords quasiparticles, strange metals, non-Fermi liquids, superconductors, black holes, entropy

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