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QuantumToolbox.jl: An efficient Julia framework for simulating open quantum systems

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Quantum simulations are essential for exploring open quantum systems. However, balancing ease of use with high computational performance remains a challenging task. In this talk, I present QuantumToolbox.jl, an open-source Julia package for simulating open quantum dynamics. Designed with a syntax familiar to users of QuTiP (Quantum Toolbox in Python), QuantumToolbox.jl leverages Julia's high-performance computing capabilities to provide efficient and scalable simulations. The package supports GPU acceleration and distributed computing without requiring significant code changes. Additionally, QuantumToolbox.jl integrates automatic differentiation tools, facilitating gradient-based optimization tasks such as quantum optimal control. Benchmark comparisons highlight substantial performance improvements, demonstrating QuantumToolbox.jl's potential as a powerful tool for quantum research.

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