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Xiaopeng Li: Quantum Reservoir Computing

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Searching for applications of programmable quantum simulation devices with quantum speedup has been attracting much research interests in recent years. In this talk, I would like to present quantum reservoir computing as a promising route to harness the computation power of quantum many-body dynamics. We find a quantum system at the edge of ergodic to non-ergodic phase transition has the best learning capacity on chaotic time sequence predictions. By configuring the quantum reservoir, we show this model is capable to perform multi-task learning, including gene regulatory networks, fractional Chua's circuit, and FX market forecast. Our configured quantum reservoir computing yields highly precise predictions for these learning tasks, outperforming classical reservoir computing. Through comparison with classical reservoir computing, we highlight the unique role of quantum coherence in the quantum reservoir, which underpins its exceptional learning performance. Our findings suggest the exciting potential of configured quantum reservoir computing for exploiting the quantum computation power of NISQ devices in developing general artificial intelligence.