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Progress in Machine Learning and Quantum Computing for Nuclear Physics Problems

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Machine learning and quantum computing are new tools for scientific research and attracted strong interests in nuclear physics. We applied the Bayesian machine learning for evaluation of noisy, discrepant and incomplete fission yields, which is a practical example of machine learning in nuclear physics [1,2,3], for which it is crucial to merger with physics information in machine learning. The data fusion by machine learning can provide more accurate and useful information [2]. Currently the quantum computing has some initial applications in studies of light nuclei and simple models. We performed quantum computing of a pairing Hamilton at finite temperature on a superconductor quantum computer [4], and applied various methods for error mitigation. We also implemented efficient quantum computing of excited states and constructed low-noise quantum circuit using symmetries. Other progress in machine learning and quantum computing for nuclear physics will also be introduced.

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2. Z. A. Wang, J. C. Pei, Y. J. Chen, C. Y. Qiao, F. R. Xu, Z. G. Ge, and N. C. Shu, Bayesian approach to heterogeneous data fusion of imperfect fission yields for augmented evaluations, *Phys. Rev. C* 106, L021304 (2022)
3. C. Y. Qiao, J. C. Pei, Z. A. Wang, Y. Qiang, Y. J. Chen, N. C. Shu, and Z. G. Ge, Bayesian evaluation of charge yields of fission fragments of ^{239}U , *Phys. Rev. C* 103, 034621 (2021)
4. Chongji Jiang and Junchen Pei, Quantum computing of the pairing Hamiltonian at finite temperature, *Phys. Rev. C* 107, 044308 (2023)

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