Quantum resources of quantum and classical variational methods

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Variational techniques have been at the heart of atomic, solid state, condensed matter and many-body physics for decades. The rich landscape of these methods recently encompassed both quantum and classical machine learning as well, forming a basis towards representing quantum states as quantum or classical neural networks. Variational methods generally aim to minimize the energy of a given ansatz and the accuracy of various methods with respect to the true energy has been extensively studied. On the other hand, open questions remain about the expressivity of various quantum and classical variational ansätze. The recently formed connection between variational techniques and quantum computing via variational quantum algorithms offers an exciting opportunity to apply quantum information classical methods. In this talk, I will show how concept of non-stabilizerness, or magic, can create a bridge between quantum information and variational techniques. Our results create a basis for a universal expressivity characterization of both quantum and classical variational methods.