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Spin models and boson sampling[1] JUAN JOSE GARCIA RIPOLL, Institute of Fundamental Physics, IFF-CSIC, Spain, BORJA PEROPADRE, ALAN ASPURU-GUZIK, Department of Chemistry and Chemical Biology, Harvard University — Aaronson Arkhipov showed that predicting the measurement statistics of random linear optics circuits (i.e. boson sampling) is a classically hard problem for highly non-classical input states [1]. A typical boson-sampling circuit requires N single photon emitters and M photodetectors, and it is a natural idea to rely on few-level systems for both tasks. Indeed, we show that 2M two-level emitters at the input and output ports of a general M-port interferometer interact via an XY-model with collective dissipation and a large number of dark states that could be used for quantum information storage. More important is the fact that, when we neglect dissipation, the resulting long-range XY spin-spin interaction is equivalent [2] to boson sampling under the same conditions that make boson sampling efficient. This allows efficient implementations of boson sampling using quantum simulators quantum computers. [1] S. Aaronson, A. Arkhipov, Proc. of the 43rd annual ACM symposium on Theory of computing (ACM, 2011) 333-342 [2] arXiv:1509.02703

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