

Developing Neutral Atom Array Quantum Processors in Singapore

Zhengjiang Li,¹ Abhishek Jamunkar,² Tong-Yan Xia,² Vasu Dev,² Kai Xiang Lee,² Jinyu Zhou,² Vincent Mancois,¹ Kelvin Lim,¹ Jintao Yang,² Thanh Nguyen,² Mujahid Aliyu,² Zilong Chen,² David Wilkowski,^{1,2} and Boon Long Ng²

¹ *School of Physical and Mathematical Sciences, Nanyang Technological University*

² *Centre for Quantum Technologies, National University of Singapore*

The effort to build quantum processors with 200 qubits or more is divided into multiple parallel subtasks to address both technical and conceptual challenges. On the technical front, we are working on a compact 2D MOT, 3D MOT, a science chamber for a 3D MOT operating in an ultrahigh vacuum environment, and a 2D neutral atom tweezer array. The 2D MOT enhances atom flux and isolates the vacuum environment of the 3D MOT through a differential pumping tube. In the 3D MOT, atoms are cooled to the microkelvin regime before being transferred into the tweezer array. On the conceptual side, we are identifying suitable atomic transitions for implementing quantum computing operations, quantum simulation, and quantum error correction.