A Continuously Reloaded Dual-Element Neutral Atom Tweezer Platform

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Dual-species neutral atom arrays provide a promising route toward a scalable quantum computing with reduced crosstalk and enhanced functionality. We present the development of a compact dual-species platform combining ^{87}**Rb** and ^{171}**Yb**. The idea is to use element-selective control between data and ancilla qubits, which allows for mid-circuit measurements with minimal disturbance to the remaining qubits. While rubidium has been used widely in quantum computing, as demonstrated in our sister lab [1], the addition of ytterbium introduces novel functionalities. At this stage, the 3D magneto-optical trap for rubidium and a 2D MOT for ytterbium have been realized as key components of the atomic source. Ytterbium atoms are emitted from an effusion cell and captured in a 2D MOT. The next steps are to transport both species into the science cell using an optical conveyor belt, where they will be loaded into static and dynamic optical tweezers. The goal is to enable continuous reloading of both species, as a step toward the implementation of more robust quantum error correction in neutral atom arrays.

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[1] J. De Santis, B. Dura-Kovács, M. Öncü, A. Bouscal, D. Vasileiadis, and J. Zeiher, *Realization of a cavity-coupled Rydberg array.* (2026) `https://arxiv.org/abs/2602.12152`

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