

Sub-Doppler cooling for ion-based qudits

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An approach to overcome the obstacles of scalability of quantum computers is to use d-level ($d>2$) quantum systems, known as qudits which are inherently present in most quantum computing platforms. While qudits provide significant additional computational resources, the underlying theory on constructing qudit computational primitives and their experimental implementation remain widely unexplored. An essential first step for any computation requires sub-Doppler cooling of the qudits. Here, we design and simulate a cooling scheme for $^{176}\text{Lu}^+$ which forms a qutrit in its 3D_1 hyperfine levels.

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