2000-times repeated imaging of strontium atoms in clock-magic tweezer arrays (Supplemental Material)

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We explore the Sisyphus cooling during imaging, and the survival fraction as a function of the red detuning and the blue scattering rate.

Figure S1(a): The survival probability of the atom versus the detuning (with respect to the free space resonance) of the 689 nm Sisyphus cooling beam. A broad feature with high survival fraction is observed with a red-detuned edge approximately at the detuning for exciting atoms at the trap bottom, consistent with our interpretation of attractive Sisyphus cooling. Data is for a 50 ms imaging time with a 461 nm scattering rate of ≈ 41 kHz. For comparison, the results in Fig. 2 are for -2.3 MHz detuning. We perform cooling during imaging with an intensity of the 689 nm beam of $I/I_s \approx 1000$, where I_s is the saturation intensity.

Figure S1(b): The survival fraction of single atoms versus the scattering rate from the 461 nm imaging beam under simultaneous repumping and Sisyphus cooling for an imaging time of 50 ms. For scattering rates $\gtrsim 80$ kHz, increased loss indicates that Sisyphus cooling is not able to compensate for 461 nm recoil heating anymore. For comparison, the results in Fig. 2 are for ≈ 41 kHz scattering rate.

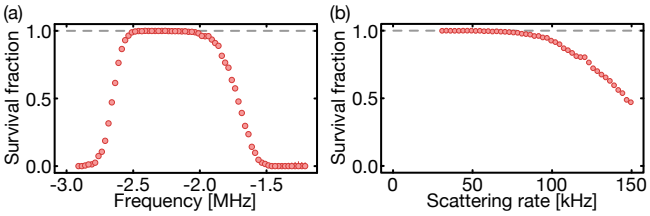

Figure S1: **Sisyphus cooling during imaging.**

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