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Grey-molasses based optical-tweezer loading: Controlling collisions for scaling up atom-array assembly MARK BROWN, TOBIAS THIELE, CHRISTOPHER KIEHL, TING-WEI HSU, CINDY REGAL, JILA / CU Boulder — An array of single neutral atoms trapped in tightly-confined optical tweezers has proven to be a powerful platform for quantum computation and quantum simulation. However, the $\sim 50\%$ single-atom loading probability inherent in the typical approach complicates the assembly of defect-free atomic configurations. Here, I present our recent work in developing a new loading technique to address this long-standing problem. By utilizing lambda-enhanced grey molasses, we exercise an unprecedented amount of control over light-assisted atomic collisions to achieve an enhanced single-atom loading rate of 90% in particularly shallow optical tweezers. We also demonstrate how combining this novel loading scheme with new rearranging techniques will be key to scaling up atom-array assembly.

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