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Numerical Calculations of Small to Large Numbers of Cold Fermions and Bosons in a 1D Double Well Potential[1] THOMAS BERGEMAN, SUNY Stony Brook — There have been many discussions of bosons in the Tonks-Girardeau (TG) regime in a quasi-1D harmonic potential, but few that consider other potential forms. Experiments can now produce double-well potentials by adding a Gaussian barrier to a harmonic potential in an array of 1D tubes, and a linear potential [1] can be used to initially displace the atom ensemble. Also, advanced techniques [2] can be used to load just a few atoms into a trap. To calculate the temporal evolution of such systems in a quasi-1D double well potential, we use an ensemble of eigenfunctions with time-dependent coefficients. Typically, we obtain complex diffraction patterns when the atom ensemble collides with the central potential barrier. We hope to extract effective tunneling rates as a function of the barrier height and width, of the initial velocity of the atom ensemble, and as a function of atom number, from the TG regime to the mean-field regime.
1. J. Reeves, D. Schneble et al., New J. Phys. **16**, 065011 (2014).
2. A. N. Wenz, S. Jochim et al., Science **342**, 457 (2013).

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