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Transport Properties of Bright Matter-Wave Dipolar Solitons in a Tonks-Girardeau gas MATTHEW EDMONDS, THOMAS BUSCH, Okinawa Inst of Sci & Tech — The dynamics of many-body systems can often be reduced to a particle analogy, leading to rich insight into their behaviour. In the one-dimensional limit the Tonks-Girardeau gas [1,2] has been realized, where strong repulsive interactions dominate the system dynamics. The creation of condensates with atoms possessing significant dipole-dipole interactions [3] heralds a novel avenue in the Ultracold landscape for the study of nonlinear waves, such as bright solitons whose interactions are intrinsically attractive. We investigate the transport properties of a Tonks-Girardeau gas with a bright soliton, for realistic geometries. We study the dynamics and equilibration of these two systems, which we quantify in terms of the strength of their mutual coupling. The dynamics are found to depend on the initial conditions, and are increasingly anharmonic as the strength of the coupling is increased, leading to the identification of different dynamical regimes. [1] B. Paredes, A. Widera, V. Murg, O. Mandel, S. Fölling, I. Cirac, G. V. Shlyapnikov, T. W. Hänsch, and I. Bloch, **429**, 277 (2004). [2] T. Kinoshita, T. Wegner, D. S. Weiss, *Science* **305**, 1125 (2004). [3] T. Lahaye, C. Menotti, L. Santos, M. Lewenstein, and T. Pfau, *Rep. Prog. Phys.* **72** 126401 (2009).

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