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Dynamics of Ultracold Atoms in the Presence of an Impurity Ion
JOHANNES M. SCHURER, ANTONIO NEGRETTI, PETER SCHMELCHER, Zentrum für Optische Quantentechnologien, Universität Hamburg — Recently, hybrid atom-ion systems have attracted more and more attention, both theoretically and experimentally. They open up new perspectives on the field of ultracold gases and allow for the study of intriguing phenomena as e.g. the formation of molecular ions [1] or ion induced density bubbles [2]. In our work, we simulate an ultracold ensemble of bosonic atoms in contact with a single ion. Thereby, we focus on effects induced by the atom-ion interaction and the impact of possible bound states onto the properties of the atomic system. Having started with the ground state properties in dependence of atom number and atom-atom interaction [3], we analyzed the atomic dynamics after a sudden creation of the ion in the atomic cloud [4]. The additional length scale in the system becomes clearly apparent and we show the necessity of the description beyond a Gross-Pitaevskii type approach. This is only possible since our study is carried out by means of the (multilayer-) multiconfiguration time-dependent Hartree method for bosons [5-6].
[1] Côté et al, Lett. 89, 093001 (2002) [2] Goold et al, PRA 81, 041601 (2010) [3] Schurer et al, PRA 90, 033601 (2014) [4] Schurer et al, NJP 17 083024 (2015) [5] Alon et al, PRA 77, 033613 (2008) [6] Cao et al, JCP 139, 134103 (2013)

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