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Collisional Aspects of Bosonic and Fermionic Dipoles in Quasi-Two-Dimensional Confining Geometries

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(Submitted on 15 Nov 2010 (v1), last revised 16 Nov 2010 (this version, v2))

Fundamental aspects of ultracold collisions between identical bosonic or fermionic dipoles are studied under quasi-two-dimensional (Q2D) confinement. In the strongly dipolar regime, bosonic and fermion species are found to share important collisional properties as a result of the confining geometry, which suppresses the inelastic rates irrespective of the quantum statistics obeyed. A potential negative is that the confinement causes dipole-dipole resonances to be extremely narrow, which could make it difficult to explore Q2D dipolar gases with tunable interactions. Such properties are shown to be universal, and a simple WKB model reproduces most of our numerical results. In order to shed light on the many-body behavior of dipolar gases in Q2D we have analyzed the scattering amplitude and developed an energy-analytic form of the pseudopotentials for dipoles. For specific values of the dipolar interaction, the pseudopotential coefficient can be tuned to arbitrarily large values, indicating the possibility of realizing Q2D dipolar gases with tunable interactions.

Comments:	4.1 pages, 3 figures
Subjects:	**Atomic Physics (physics.atom-ph)**
Cite as:	**arXiv:1011.3469v2 [physics.atom-ph]**

Submission history

From: Jose D'Incao [view email]
[v1] Mon, 15 Nov 2010 18:19:45 GMT (2507kb)
[v2] Tue, 16 Nov 2010 04:21:09 GMT (2776kb)

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