

Abstract Submitted
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Novel Infrared Dynamics of Cold Atoms on Hot Graphene

SANGHITA SENGUPTA, VALERI KOTOV, DENNIS CLOUGHERTY, Univ of Vermont — The low-energy dynamics of cold atoms interacting with macroscopic graphene membranes exhibits severe infrared divergences when treated perturbatively. These infrared problems are even more pronounced at finite temperature due to the (infinitely) many flexural phonons excited in graphene. We have devised a technique to take account (resummation) of such processes in the spirit of the well-known exact solution of the independent boson model. Remarkably, there is also similarity to the infrared problems and their treatment (via the Bloch-Nordsieck scheme) in finite temperature “hot” quantum electrodynamics and chromodynamics due to the long-range, unscreened nature of gauge interactions. The method takes into account correctly the strong damping provided by the many emitted phonons at finite temperature. In our case, the inverse membrane size plays the role of an effective low-energy scale, and, unlike the above mentioned field theories, there remains an unusual, highly nontrivial dependence on that scale due to the 2D nature of the problem. We present detailed results for the sticking (atomic damping rate) rate of cold atomic hydrogen as a function of the membrane temperature and size. We find that the rate is very strongly dependent on both quantities.

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