Abstract Submitted
for the DAMOP17 Meeting of
The American Physical Society

Quantum Dynamics in the HMF Model[1] RYAN PLESTID, DUNCAN O'DELL, McMaster University — The Hamiltonian Mean Field (HMF) model represents a paradigm in the study of long-range interactions but has never been realized in a lab. Recently Shutz and Morigi (PRL 113) have come close but ultimately fallen short. Their proposal relied on cavity-induced interactions between atoms. If a design using cold atoms is to be successful, an understanding of quantum effects is essential. I will outline the natural quantum generalization of the HMF assuming a BEC by using a generalized Gross-Pitaevskii equation (gGPE). I will show how quantum effects modify features which are well understood in the classical model. More specifically, by working in the semi-classical regime (strong interparticle interactions) we can identify the universal features predicted by catastrophe theory dressed with quantum interference effects. The stationary states of gGPE can be solved exactly and are found to be described by self-consistent Mathieu functions. Finally, I will discuss the connection between the classical description of the dynamics in terms of the Vlassov equation, and the gGPE.

[1]We would like to thank the Government of Ontario's OGS program, NSERC, and the Perimeter Institute of Theoretical Physics

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Date submitted: 27 Jan 2017 Electronic form version 1.4