Abstract Submitted
for the DAMOP15 Meeting of
The American Physical Society

Degeneracy and Inversion of Band Structure for Wigner Crystals on a Helix PETER SCHMELCHER, ALEXANDRA ZAMPETAKI, JAN STOCKHOFE, Centre for Optical Quantum Technologies, Department of Physics, University of Hamburg, CENTRE FOR OPTICAL QUANTUM TECHNOLOGIES THEORY GROUP COLLABORATION — We explore the formation of Wigner crystals for charged particles on a toroidal helix. Focusing on certain commensurate cases we show that the ground state undergoes a pitchfork bifurcation from the totally symmetric polygonic to a zig-zag-like configuration with increasing radius of the helix. Remarkably, we find that for a specific value of the helix radius, below the bifurcation point, the vibrational frequency spectrum collapses to a single frequency. This allows for an essentially independent small-amplitude motion of the individual particles and consequently localized excitations can propagate in time without significant spreading. Increasing the radius beyond the degeneracy point, the band structure is inverted, with the out-of-phase oscillation mode becoming lower in frequency than the mode corresponding to the center of mass motion.

Peter Schmelcher
Centre for Optical Quantum Technologies,
Department of Physics, University of Hamburg

Date submitted: 19 Dec 2014 Electronic form version 1.4