Abstract Submitted
for the DAMOP18 Meeting of
The American Physical Society

Pairing in the Peierls/Su-Schrieffer-Heeger(SSH) model: From light spinful bipolarons to self-trapping of hard-core pairs and repulsive bipolarons[1] JOHN SOUS, MONA BERCIU, ROMAN KREMS, University of British Columbia — It is widely accepted that strong particle-phonon coupling generally makes the resulting polarons and bipolarons heavy, with masses increasing smoothly with the coupling strength with no self-trapping transitions. This is the characteristic behaviour in the Holstein and Fröhlich models. Here, we study the one-dimensional Peierls/Su-Schrieffer-Heeger(SSH) model necessary for describing coupling of hopping to breathing-mode distortions in certain oxides, polyenes and quantum simulators based on ultracold lattice systems. We show that the Peierls interactions bind polarons into light bipolarons, which could undergo Bose-Einstein condensation at high temperatures. This proves that phonon-mediated high-Tc superconductivity is possible. We also find that for particles with hard-core statistics, interactions mediated by Peierls phonons are repulsive. The interplay of hard-core statistics and phonon-mediated hopping leads to a transition characterized by flattening of the bipolaron dispersion, suggestive of self-trapping. The repulsive phonon-mediated interactions also lead to a repulsively bound bipolaron state appearing above the two-polaron continuum. These results provide a specific path to utilize Peierls coupling to control superconductivity and quantum transport.

[1]This work was supported by NSERC, SBQMI, and ITAMP.

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Date submitted: 26 Jan 2018 Electronic form version 1.4