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Quantum coherence of Hard Core Bosons and Fermions in one dimensional quasi-periodic potentials: superfluid, Mott and glassy phases
ANA MARIA REY, ITAMP, Harvard-Smithsonian Center of Astrophysics, Cambridge, MA, 02138., INDUBALA I SATIJA , Dept. of Physics, George Mason University, Fairfax, VA, 22030, CHARLES W CLARK, NIST, Gaithersburg MD, 20899 — We use Hanbury- Brown-Twiss interferometry (HBTI) to characterize and contrast the different quantum phases exhibited by hard core bosons (HCBs) and ideal fermions confined in a one-dimensional quasi-periodic potential. In addition to the Bose-glass, superfluid and Mott insulator phases characteristic of interacting disordered bosons, we show the quasi-periodic potential induces a cascade of Mott-like band insulator transitions triggered by the fermion-type statistics of HCBs . A comparative study of the fermion model shows that except for a sign difference, HCB and fermion interferometric patterns coincide in the localized phases. In the extended phase, however, fermions behave quite differently ; their correlation functions reflect some of the multi-fractal properties characteristic of the metal-insulator transition. When plotted as a function of the filling factor, their quasi-momentum distribution displays an Arnold tongue-like structure and the HBTI peak intensity follows a step-like pattern which resembles a devil's staircase at the onset of the localization transition.

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