

Abstract Submitted  
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**Disordered commensurate bosons: 20-year-old conjectures are now theorems** BORIS SVISTUNOV, University of Massachusetts, Amherst, VICTOR GURARIE, University of Colorado, Boulder, LODE POLLET, Harvard University, NIKOLAY PROKOF'EV, University of Massachusetts, Amherst, MATTHIAS TROYER, ETH, Zurich — We prove the theorem of inclusions stating that in the presence of generic, bounded disorder there exist rare, but arbitrarily large, regions of the competing phase across the generic transition line. We argue that the only non-generic phase transitions are the Griffiths-type ones, driven by rare regions in which disorder emulates some regular external perturbation. An immediate implication of the theorem of inclusions is the absence of direct superfluid-to-gapped-insulator quantum phase transitions, in the presence of this type of disorder, no matter how weak. With an enhanced version of the theorem of inclusions we prove finite compressibility (and thus relevance of disorder) on the critical line of superfluid to Bose glass transition. The exceptional role of the Griffiths-type transitions implies that the transition from Mott insulator to any gapless insulator should be inevitably of this type.

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