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**Rydberg facilitated charge transport in an optical lattice** RICK MUKHERJEE, Max Planck Institute for the Physics of Complex Systems, IGOR LESANOVSKY, University of Nottingham, THOMAS POHL, Max Planck Institute for the Physics of Complex Systems — We study the dynamics of a single ion trapped in a lattice that is otherwise filled with neutral atoms. For typical lattice spacings, there exist highly excited electronic (Rydberg) states in which the ion and an adjacent atom form a charged molecule. We show that the laser coupling to these molecular Rydberg states induces a charge exchange dynamics which effectively results in the transport of the ion through the lattice. The character of the transport crucially depends on the coupling between the electronic dynamics and the vibrational motion of the atoms and ion. We formulate a criterion for distinguishing coherent and incoherent regimes and demonstrate that aspects of the transport dynamics such as its direction can be controlled by the excitation laser.

Rick Mukherjee  
Max Planck Institute for the Physics of Complex Systems

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