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Absence of Landau damping in driven three-component Bose–Einstein condensate in optical lattices[1] GAVRIIL SHCHEDRIN, DANIEL JASCHKE, LINCOLN D. CARR, Colorado School of Mines — Multicomponent Bose-Einstein condensates (BECs) are a unique form of matter that allow one to explore coherent many-body phenomena in a macroscopic quantum system by manipulating its internal degrees of freedom. The ground state of alkali-based BECs, which includes ^{7}Li, ^{23}Na, and ^{87}Rb, is characterized by the hyperfine spin F, that can be best probed in optical lattices, which liberate its $2F+1$ internal components and thus provides a direct access to its internal structure. We explore the quantum many-body physics of a three-component Bose-Einstein condensate in optical lattices driven by laser fields in V and Λ configurations. We obtain exact analytical expressions for the energy spectrum and amplitudes of elementary excitations, and discover symmetries among them. We demonstrate that the applied laser fields induce a gap in the otherwise gapless Bogoliubov spectrum. We find that Landau damping of the collective modes above the energy of the gap is carried by laser-induced roton modes and is considerably suppressed compared to the phonon-mediated damping endemic to undriven scalar condensates.

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