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Ioffe-Regel localization of longitudinal acoustic excitations and the Arrhenius crossover regime in glass-forming metallic liquids ABHISHEK JAISWAL, YANG ZHANG, University of Illinois at Urbana-Champaign — The Ioffe-Regel (IR) criterion is known to distinguish the boundary between propagating and localized excitations. In previous studies of liquids the localization of transverse excitations within atomic cages at high-temperature has been elucidated using the IR limit. Much less emphasis has been put on the nature of longitudinal excitations and the IR limit. Herein, we map out the wavelength dependent IR crossover temperature of the longitudinal excitations in an excellent Cu-Zr-Al based glass-former. We find that the inflection point of this map occurs at the Arrhenius crossover temperature T_A identified from deviations of Arrhenius form in transport properties and the breakdown of Stokes-Einstein relation. The corresponding wavelength of longitudinal excitations at T_A equals the limit where all partial pair distribution functions $g(r)$ of the liquid approaches the random structure limit, essentially marking the boundary between the discrete and the continuous liquid. This map allows us to extract a temperature range for the Arrhenius crossover or the landscape-influenced regime in a glass-forming liquid.

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