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Wavelength dependent high-energy ion emission from intense mid-IR laser-cluster interaction[1] HYUNWOOK PARK, ZHOU WANG, PIERRE AGOSTINI, LOUIS DIMAURO, The Ohio State University — We present the first measurements on the wavelength dependence from the near-infrared to mid-infrared of inert gas clusters interacting with an intense, ultrafast pulse. In the experiments, ion energy distributions have been recorded with various wavelength (0.8-2.2 μm), while all other conditions are fixed. It is found that the wavelength plays a significant role in electron-plasma heating and thus energetic ion production. The maximum energy of the detected ion, E_{max}, decreases with increasing wavelength, reaches a minimum, then increases. We attribute this result to two different electron-heating mechanisms depending on the wavelength- volume (Inverse Bremsstrahlung: IB) and surface (Brunel) heating. In the short wavelength regime (0.8-1.5 μm), IB heating dominates the production of multiply charged ions, since the electrons are resonantly heated near plasma frequency. As the wavelength is increased, IB heating is progressively suppressed, resulting in a smaller value of E_{max}. Brunel heating, on the other hand, increases due to a quadratic increase of the electrons ponderomotive energy, and becomes dominant in the long wavelength regime (1.7-2.2 μm). The lowest E_{max} values would thus occur at the wavelength where the dominant heating mechanism switches from volume to surface.

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