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Enhanced ion beam energy by relativistic transparency in laser-driven shock ion acceleration[1] YOUNG-KUK KIM, School of Electrical and Computer Engineering, Ulsan Natl Inst of Sci Tech, MIN SUP HUR, School of Natural Science, Ulsan Natl Inst of Sci Tech — We investigated the effects of relativistic transparency (RT) on electrostatic shock ion acceleration. Penetrating portion of the laser pulse directly heats up the electrons to a very high temperature in backside of the target, resulting in a condition of high shock velocity. The reflected portion of the pulse can yield a fast hole boring and density compression in near-critical density plasma to satisfy the electrostatic shock condition; 1.5 <M <3.7. The high speed electrostatic shock reflects upstream ions up to velocity ˜2v$_{sh}$. In 1D PIC simulation, we have clearly observed RT-based shock acceleration which generates significantly higher ion beam energy in comparison to that in a purely opaque plasma. In multi-dimensional systems, various instabilities should be considered such as Weibel-like instability, which causes filamentation during the laser penetration. From series of comparisons of linearly polarized and circularly polarized pulses for the RT-based shock, we observed the circularly polarized pulse is usually more advantageous in reducing the instability, possibly leading to better RT-based shock acceleration.

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Young-Kuk Kim
School of Electrical and Computer Engineering, Ulsan Natl Inst of Sci Tech

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