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Density bunching effects in a laser-driven, near-critical density plasma for ion acceleration OLIVER ETTLINGER, AAKASH SAHAI, GEORGE HICKS, EMMA-JANE DITTER, The John Adams Institute of Accelerator Science, Department of Physics, Imperial College London, SW7 2AZ, NICHOLAS DOVER, High Intensity Laser Science Group, Kansai Photon Science Institute, 8-1-7 Umemidai, Kizugawa-shi, Kyoto, 619-0215 Japan, YU-HSIN CHEN, MICHAEL HELLE, DANIEL GORDON, ANTONIO TING, Plasma Physics Division, Naval Research Laboratory, Washington D.C. 20375 USA, MIKHAIL POLYANSKIY, IGOR POGORELSKY, MARCUS BABZIEN, Accelerator Test Facility, Brookhaven National Laboratory, Upton, New York 11973, USA, ZULFIKAR NAJMUDIN, The John Adams Institute of Accelerator Science, Department of Physics, Imperial College London, SW7 2AZ — We present work investigating the interaction of relativistic laser pulses with near-critical density gas targets exhibiting pre-plasma scale lengths of several laser wavelengths. Analytical and computational modelling suggest that the interaction dynamics in a low-Z plasma is a direct result of induced density bunching up to the critical surface. In fact, these bunches can themselves become overcritical and experience significant radiation pressure, accelerating ions to higher energies compared to an "idealised" plasma slab target. This work will be used to help explain the observation of ion energies exceeding those predicted by radiation pressure driven hole-boring in recent experiments using the TW CO_2 laser at the Accelerator Test Facility at Brookhaven National Laboratory.

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