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Exotic hollow atom states pumped by relativistic laser plasma in a radiation dominant regime NIGEL WOOLSEY, York Plasma Institute, Department of Physics, University of York, S.A. PIKUZ, A. YA FAENOV, JIHT, Russian Academy of Sciences, R.J. DANCE, E. WAGENAARS, University of York, N. BOOTH, STFC Central Laser Facility, O. CULFA, University of York, R.G. EVANS, Imperial College, London, R.J. GRAY, University of Strathclyde, T. KAEMPFER, Helmholtz Institut Jena, K.L. LANCASTER, University of York, P. MCKENNA, University of Strathclyde, A.L. ROSSALL, University of York, I. YU SKOBELEV, JIHT, Russian Academy of Sciences, K.S. SCHULZE, I. USCHMANN, Helmholtz Institut Jena, A.G. ZHIDKOV, Japan Atomic Energy Agency, J. ABDALLAH JR., J. COLGAN, Los Alamos National Laboratory — In high-spectral resolution experiments with the petawatt Vulcan laser, strong x-ray radiation of KK hollow atoms (atoms without n = 1 electrons) from aluminium targets was observed at high laser contrast, for intensities of 3x10^{20} Wcm^{-2} and micron thick targets. These spectral observations are interpreted using detailed atomic kinetics calculations suggesting these exotic hollow atom states occur at near solid density and are driven by an intense polychromatic x-ray field. We estimate that this x-ray radiation field has energy in the kilovolt range and has an intensity exceeding 10^{18} Wcm^{-2}. The field may arise through relativistic electron Thomson scattering and bremsstrahlung in the electrostatic fields at the target surface.

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