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Electromagnetic cascades and the depletion of intense fields.¹

STEPAN BULANOV, Lawrence Berkeley National Laboratory, DANIEL SEIPT, Helmholtz-Institut Jena, Germany, THOMAS HEINZL, Plymouth University, Plymouth, UK, MATTIAS MARKLUND, Chalmers University of Technology, Gothenburg, Sweden, QING JI, SVEN STEINKE, CARL SCHROEDER, ERIC ESAREY, WIM P. LEEMANS, Lawrence Berkeley National Laboratory — The interaction of electrons, positrons, and photons with intense electromagnetic fields gives rise to multi-photon Compton and Breit-Wheeler processes. It is shown that electrons and/or positrons undergo a cascade-type process involving multiple emissions of photons. These photons can consequently convert into electron-positron pairs. As a result charged particles quickly lose their energy developing an exponentially decaying energy distribution. Moreover the multi-photon nature of Compton and Breit-Wheeler processes implies the absorption of a significant number of photons. As a result, the interaction of a highly charged electron bunch with an intense laser pulse can lead to a significant depletion of the laser pulse energy, thus rendering the external field approximation invalid. The relevance of these results to the proposed BELLA-i beamline at BELLA center at LBNL is discussed.

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