

Collective Plasma Effects in Beam-Driven QED Cascades

K QU¹, S MEUREN^{1,2}, AND N J FISCH¹

¹*Department of Astrophysical Sciences, Princeton University, Princeton NJ, USA*

²*SLAC National Laboratory, Stanford PULSE Institute, Menlo Park CA, USA*

Contact Email: kq@princeton.edu

QED cascades play an important role in extreme astrophysical environments like magnetars. They can also be produced by passing a relativistic electron beam through an intense laser field, as shown in Fig. 1. Signatures of collective pair plasma effects in these QED cascades are shown to appear, in exquisite detail, through plasma-induced frequency upshifts in the laser spectrum. Remarkably, these signatures can be detected even in small plasma volumes moving at relativistic speeds. Strong-field quantum and collective pair plasma effects can thus be explored with existing technology, provided that ultra-dense electron beams were co-located with multi-PW lasers.

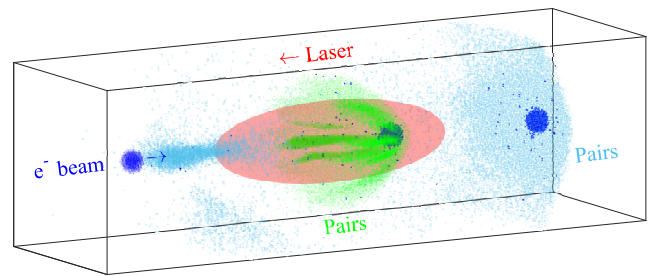


Figure 1: 3D PIC simulation of a beam-driven QED cascade

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