Abstract Submitted for the DPP16 Meeting of The American Physical Society

Exploring the orbital angular momentum of betatron radiation JOANA MARTINS, GUENDA HEHMANN, RICARDO FONSECA¹, LUIS SILVA, JORGE VIEIRA, GoLP/IPFN, Instituto Superior Tecnico - Universidade de Lisboa, Lisboa, Portugal — Betatron radiation from laser-wakefield accelerators (LWFA) can be used as a broadband X-ray source. Betatron x-rays have attracted great interest and have applications in biological imaging which have been demonstrated experimentally (see for instance A. Rousse et al., Phys. Rev. Lett. 93, 135005 (2004); S. Kneip et al., Nat. Phys. 6, 980). Endowing betatron radiation with well defined states of orbital angular momentum (OAM), a fundamental property of light by which its wave fronts become twisted, could further enhance the imaging spatial resolution. However, the conditions for the generation of betatron x-rays with OAM, and the fundamental mechanisms underlying the transfer of OAM from electron trajectories to the radiation they emit, remain outstanding open questions. To explore these exciting open challenges, we investigate the OAM spectral content of betatron x-rays in LWFA. We explore the conditions and laser driver characteristics (with/without orbital and spin angular momentum) that can enable the emission of OAM x-rays. We support our studies by 3D numerical modelling, using the particlein-cell code Osiris [R.A. Fonseca et al, PPCF, 55 124011 (2013)] and using the post processing radiation code jRad [J. L. Martins et al., Proc. SPIE 7359, 73590V (May 07, 2009)].

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