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Strong Optical Shock excitation in the mismatched regime of bubble plasma-wave based LWFA[1] AAKASH SAHAI, Dept of Physics and John Adams Institute for Accelerator Sciences, Imperial College London, London — We present investigations into the excitation of a strong optical shock [1] through slicing of a high intensity laser pulse driving a bubble plasma wave in a regime of mis-match between the incident laser waist-size and the bubble size ($\simeq 2\ \sqrt{a_0}\ c/\omega_{pe}$) [2]. In the matched regime, it is well-known that over long timescales, the laser continuously undergoes differential frequency-shifts in different bubble phases, forming an optical shock [2][3]. In the mis-matched regime, rapid laser waist and resulting bubble oscillations change the location of the peak laser ponderomotive force. This changes the location and the magnitude of the peak electron density interacting with the laser pulse. A sudden increase in the electron density during a laser radial squeeze event, slices the laser envelope longitudinally near its peak amplitude, exciting a strong optical shock state. This is shown to occur much earlier in laser evolution only over a narrow range of plasma densities where the imbalance between the longitudinal radial ponderomotive forces excites elongated bubbles, injects ultra-low emittance electron beams and sustains ultra-high peak plasma fields [4]. [1] PRL 84, 3582 (2000) [2] PRSTAB 10, 061301 (2007) [3] NJP 12, 0450 (2010) [4] arXiv:1704.02913 (2017)

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