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Ultra-high gradient superradiant amplification in the wake of an intense laser pulse JASON COLE, MATTHEW STREETER, NELSON LOPES, KRISTJAN PODER, JONATHAN WOOD, NICHOLAS DOVER, MICHAEL BLOOM, ANDREAS DOPP, Imperial College London, WILLIAM SCHUMAKER, University of Michigan, CHRIS MURPHY, University of York, GIANLUCA SARRI, MATT ZEPF, Queen's University Belfast, ALEC THOMAS, KARL KRUSHELNICK, University of Michigan, STUART MANGLES, ZULFIKAR NAJMUDIN, Imperial College London — The peak intensity attainable in a high-power laser system is limited by the damage thresholds of its components, necessitating the use of large and expensive optics. Backwards Raman amplification (BRA) has been proposed as a method for the amplification of short pulses, where a pump beam resonantly scatters into a seed beam in the presence of a plasma which is not susceptible to optical damage. While promising in simulation, BRA has proven a significant experimental challenge with few standout successes. An alternative technique which operates at higher pump intensities is superradiant amplification (SRA), relaxing the requirements on frequency matching of the pump and seed which constrain experimental implementations of BRA. Here we demonstrate that at pump intensities three orders of magnitude above those conventionally used in BRA, the SRA mechanism supports the 10^5 fold amplification of an equal-frequency seed pulse over micron length scales.

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