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**Plasma-based amplification of laser beams with higher-order polarization modes** RAOUL M TRINES, STFC RAL, Didcot, UK, J VIEIRA, RA FONSECA, JT MENDONCA, LO SILVA, IST Lisbon, Portugal, EP ALVES, SLAC, R BINGHAM, STFC RAL, Didcot, UK — Parametric amplification of laser pulses in plasma has been used to amplify both simple Gaussian pulses as well as higher-order Laguerre-Gaussian modes. However, the amplified beams always had a simple mode of polarisation, only linear or circular. Here we present a novel scheme to amplify seed laser pulses with complex modes of polarisation, so-called Poincaré beams, using default Gaussian pump laser beams with simple linear or circular polarisation. As particular examples, we will discuss the amplification of seed laser pulses with radial or azimuthal polarisation, as well as a pulse with polarisation shaped like a Möbius strip.

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