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Time-resolved turbulent dynamo in a laser plasma with order-unity magnetic Prandtl number ARCHIE BOTT, Princeton University, PETROS TZEFERACOS, University of Rochester, LAURA CHEN, University of Oxford, CHARLOTTE PALMER, Queens University Belfast, ALEXANDER SCHEKOCHIHIN, University of Oxford, DON LAMB, University of Chicago, GIANLUCA GREGORI, University of Oxford, TDYNO COLLABORATION — Understanding magnetic-field generation and amplification in turbulent plasma is essential for explaining the presence of magnetic fields in the universe. A theoretical framework attributing these fields to the so-called fluctuation dynamo was recently validated by experiments on laser facilities in low-magnetic Prandtl-number (low-Pm) plasmas. However, the same framework proposes that the fluctuation dynamo should behave quite differently for large Pm, the regime relevant to many astrophysical environments. This talk reports a new experiment which creates a high-Pm plasma dynamo. We provide a time-resolved characterization of the plasma's evolution, measuring temperatures, densities, flow velocities and magnetic fields. The magnetic energy in structures with characteristic scales close to the driving scale of the stochastic motions is found to increase by almost three orders of magnitude from its initial value. It is shown that the growth of these fields occurs exponentially at a rate that is much faster than the turnover rate of the driving-scale stochastic motions. Our results point to the possibility that plasma turbulence produced by strong shears may generate driving-scale fields more efficiently than would be anticipated from MHD simulations of the fluctuation dynamo.

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