Nonlinear Plasma Phenomena: Observation of Relativistic Postsolitons and Rayleigh Taylor Like Instabilities

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High intensity laser pulses with spatio-temporal aberations give rise to a number of instabilities while propagating through an underdense plasma. A pulse front tilt, for example, can lead to a transverse oscillation of the laser pulse which leaves its imprint on the remaining plasma channel. The boundary surface of these modulated plasma channels is prone to Rayleigh Taylor like instabilities. Using few-cycle microscopy we were able to observe this phenomena. Furthermore, when the laser pulse has depleted its energy in the plasma and undergoes collapse, postsolitons can form. We investigated their evolution and observed coherent emission.

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