High Harmonics and Attosecond Pulses as Diagnostics of Intensity Spikes in Laser Filamentation.

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We show that the laser intensity in an ultrashort pulse filament can exceed the clamping intensity by more than a factor of three over several cm of propagation. We have performed fully non-adiabatic calculations of filamentation self-compression and the generation of coherent XUV radiation via HHG in argon at atmospheric pressure. We show that both the high-intensity laser pulse and the XUV radiation can be coupled out of the filament via a short pressure gradient, and that the XUV light emerges from the truncated filament as an isolated self-focused attosecond pulse with a peak intensity approaching 10^{11} W/cm^2. We discuss that the XUV yield presents an excellent diagnostic of the intensity spikes because of its extremely nonlinear dependence on peak intensity.