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Compression, spectral broadening, and collimation in multiple femtosecond pulse filamentation in atmosphere JOHN PALASTRO, THOMAS ANTONSEN, HOWARD MILCHBERG, University of Maryland — A sequence of femtosecond laser pulses propagating through atmosphere and delayed near the rotational recurrence period of N2 can resonantly drive molecular alignment. Through the polarization density, the molecular alignment provides an index of refraction contribution that acts as a lens copropagating with each laser pulse. Each pulse enhances this contribution to the index modifying the propagation of subsequent pulses. Here we present propagation simulations of femtosecond pulse sequences in which we have implemented a self consistent calculation of the rotational polarization density using linear density matrix theory. We find that a femtosecond pulse sequence can enhance pulse compression or collimation in atmosphere. In particular, when the pulses are delayed by exactly the rotational recurrence period, each subsequent pulse is increasingly compressed due to a combination of spectral broadening and negative dispersion. Alternatively, when the intensity peak of each pulse is centered on the maximum index generated by the proceeding pulses, each pulse is increasingly collimated.

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