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Title: Atmospheric applications of intense ultrashort-pulse lasers

Abstract: Ultrashort-pulse laser beams with multi-gigawatt peak power propagate in the air in the self-channeling regime leaving behind traces of dilute plasma. This propagation regime, termed laser filamentation, has several potential applications. I will discuss two of them. The first application is the so-called air lasing. The concept of air lasing is based on the utilization of the constituents of the air itself for the generation of standoff, impulsive laser action. While both forward-propagating and backward-propagating laser emissions can be generated, the backward-propagating emission is of the most practical significance, as it enables single-ended remote sensing schemes and guide stars. I will review recent results on air lasing from singly ionized nitrogen molecular ions N_2^+ , pumped through femtosecond laser filamentation in air. So far, lasing has been demonstrated only in the forward direction and the mechanisms that enable population inversion have been controversial. The second potential applications of air plasma is for the guidance of electrical breakdown of air. The diluteness and sub-nanosecond lifetime of the plasma limits the extent of the guidance. I will discuss approaches that help alleviate these limitations.