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Frequency Conversion and Intensification of Laser Pulses Reflected from Ionization Waves of Arbitrary Velocity PHILIP FRANKE, JOHN PALASTRO, DAVID TURNBULL, DUSTIN FROULA, Laboratory for Laser Energetics, U. of Rochester — A recently pioneered optical technique called the flying focus allows for the position of maximum laser intensity in a chromatically focused, chirped laser pulse to be propagated at any velocity over long distances. An ionization front that moves at the flying focus velocity has been demonstrated when the instantaneous intensity is above the ionization threshold of a background material. These ionization waves of arbitrary velocity (IWAV's) can be propagated backward with respect to the laser group velocity, eliminating the effect of ionization refraction and allowing for the production of high-density IWAV's moving arbitrarily close to, or even exceeding the speed of light. When a second laser pulse is reflected from an IWAV, it can undergo extreme shifts in frequency because of the double-Doppler effect, as well as intensification because of pulse compression. Calculations show that even for diffuse ionization fronts, a frequency upshift of nearly 20 can be achieved beginning with infrared laser pulses. The output pulse duration and intensity can be tuned by chirping the input pulse, and the output frequency can be tuned by adjusting the flying focus velocity. Preliminary results suggest that this process could enable high-intensity, ultrashort, tunable frequency laser pulses in the extreme ultraviolet to soft x-ray regime. This material is based upon work supported by the Department of Energy grant DE-SC0019135 and the Department of Energy National Nuclear Security Administration under Award Number DE-NA0003856.

Philip Franke
Laboratory for Laser Energetics, U. of Rochester

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