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Inertial Fusion Target Physics Advantages with the Krypton Fluoride Laser[1]

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The krypton fluoride (KrF) laser's short wavelength, broad bandwidth and capability to provide extremely uniform target illumination are advantages towards obtaining high gain direct drive implosions. The short wavelength helps suppress deleterious laser-plasma instabilities, and allows one to employ higher ablation pressures. In addition, the KrF architecture allows one to zoom down the focal diameter to follow the size of the imploding pellet, thereby improving the coupling efficiency. The NRL researchers have been conducting theoretical and experimental studies to quantify the beneficial effects of utilizing KrF light. Experiments using the Nike facility have confirmed that KrF light significantly increases the threshold for laser-plasma instability. This presentation will discuss the observed target physics with KrF light and its effects towards facilitating the high gains needed for power production with inertial fusion. Simulations indicate that shock ignited designs can achieve gains above 200 with KrF energies as low a 1 megajoule. For fusion energy a laser driver must be capable of high repetition rates (5-10 Hz) along with adequate efficiency and durability. The Electra KrF 30-cm aperture electron-beam-pumped amplifier has demonstrated long duration continuous operation at high-repetition rates. This and other advances show that the KrF laser should be able to meet the requirements.

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