X-ray lasers: The evolution from Star Wars to the table-top

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In this talk we tell the story of the X-ray laser, which began as an attempt to extend optical lasers to shorter wavelengths in the 1970's. Research took off in the 1980's driven by the rivalry between the US and Soviet Union in their quest to create a "Star Wars" laser shield against ICBM's. At the same time large inertial fusion confinement (ICF) lasers, such as Novette and Nova at LLNL, were able to create the first laboratory X-ray lasers in Ne-like Se at 20.6 and 20.9 nm using 2 kJ of energy in a 0.5 ns pulse. These large ICF lasers could only be fired every few hours and used very thin expensive exploding foils as the targets. With the demonstration of the pre-pulse technique at Nova, where a small pulse of a few joules heated a solid target and create a pre-plasma that was then be heated by a second large pulse to create the lasing conditions, X-ray lasers started working robustly at many laser facilities around the world. The advent of high repetition rate psec lasers combined with the pre-pulse technique and grazing incident geometry opened the door to the many table-top X-ray lasers today which can be driven by less than 1 J of energy and operate 100 Hz repetition rates. This has opened many new research opportunities for scientific research using X-ray lasers.

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