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Ultrafast and ultrastable lasers for quantum technologies

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Quantum optics has typically been associated with experiments involving optical fields with low mean number of photons. However, recent studies have demonstrated that macroscopic quantum states of light can be generated with intensities high enough to drive extreme nonlinear processes like high-harmonic generation. The workhorse for these breakthrough experiments has been a Ti:sapphire laser technology, which is limited to the near-infrared spectral range. Here, we present a source of controllable single-cycle mid-infrared laser pulses based on a Cr:ZnS mode-locked laser, often referred to as the “long-wavelength Ti:sapphire”. This technology provides a promising platform for exploring ultrafast quantum phenomena in the longer wavelength domain.

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