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Production of single-cycle laser pulses through nonlinear pulse compression

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Today, most ultrashort lasers are already capable of producing pulses in the order of dozens of femtoseconds using mode-locked Ti:Sapphire oscillators. This pulses have paved the way to the emergence of attosecond science by enabling the generation of XUV pulses of several tenths of attoseconds duration via high-harmonic generation. This ultrashort pulses are the tools of choice for exploring electron dynamics inside atoms, molecules and solids or in nanostructures and they are necessary for understanding fundamental phenomena like magnetism or charge migration inside molecules.
In the Voxel laboratory we will implement a setup to shorten the 35fs pulse that currently exists in the lab into the sub 5fs regime using a state of the art method: after the existing a amplifier we will put the pulse through a Hollow Fiber Compressor to broaden the bandwidth, and then a compressor/metrology d-scan system from *Sphere Ultrafast Photonics* to simultaneously measure and optimize (i.e., re-compress) the pulse.
After getting such ultrashort pulses, we plan on designing a Fourier Holography experimental setup, a technique that utilizes attosecond soft x-ray pulses to image nanometer-scale objects so as to take advantage of the ultrashort pulses created.

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