**Novel nonlinear phenomena driven by intense, structured femtosecond magnetic pulses**

The degree of control we have achieved over the manipulation of light is truly amazing. Initiated by our Greek ancestors using mirrors to guide light, we live in a world where the most advanced laser technology allows us to create and sculpt light beams with great precision. In particular, nowadays we can create ultrashort attosecond pulses (with durations of trillionths of a second), of very high frequencies (up to the soft X-rays), and with increasingly complex spatial structures thanks to our ability to harness their angular momentum. Very interestingly, by harnessing ultrafast structured laser pulses, it has been recently proposed the possibility to generate intense, ultrafast magnetic pulses isolated from the electric field.

In this talk we will review our recent work in the generation of structured ultrashort laser pulses, and their potential to explore ultrafast magnetism. On the one side, thanks to the highly nonlinear process of high harmonic generation, we can tailor the spin and orbital angular momentum properties of extreme ultraviolet/soft x-ray laser pulses directly at their generation. In particular we have found that HHG assisted by an intense, isolated magnetic field with the proper polarization choice, results in the emission of Fourier-limited attosecond pulses in the soft X-ray regime. On the other side, we show that non-linear magnetic field effects driven by structured laser pulses provide a way to manipulate the magnetic order of ferro- and antiferromagnetic materials. We introduce a novel ferromagnetic switching scheme on femtosecond time-scales that can be achieved by purely magnetic precession of the magnetization with field amplitudes of hundreds of Tesla.

In summary, structured laser pulses offer an appealing alternative to study sub-femtosecond magnetization dynamics, where a complete understanding of the electronic and spin interactions remains unexplored.