

Optical Atomic Clocks: From Laboratory Experiments to International Timekeeping

Dr Helen Margolis

National Physical Laboratory

The most advanced optical atomic clocks have now reached levels of stability and accuracy that significantly surpass the performance of the best caesium primary frequency standards. As a result, the possibility of a future redefinition of the second in terms of an optical transition frequency is being actively considered by the international metrology community.

At NPL we are developing optical atomic clocks based on two different types of technology: single laser-cooled ions confined in radiofrequency ion traps, and arrays of laser-cooled atoms trapped in an optical lattice. The principles of operation of these clocks, their current state-of-the-art performance and their potential applications will be described, as well as the methods we use to compare optical clocks both locally and between different national metrology institutes. Finally, I will discuss a new European project that aims to tackle the key challenges that must be addressed before optical atomic clocks can be used for international timekeeping.