*URSI AP-RASC 2019, New Delhi, India, 09 - 15 March 2019*

# Optical Atomic Clocks

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For many centuries, and continuing today, a primary application of accurate clocks is for precise navigation. For example, GPS enables us to determine our distance from the (known) positions of satellites by measuring the time it takes for a pulse of radiation emitted by the satellite to reach us. The more accurately we can measure this time, the more accurate our position is known.

Atoms absorb electromagnetic radiation at precise discrete frequencies. Knowing this, a recipe for making an atomic clock is simple to state: we first need an oscillator to produce the radiation and a device that tells us when the atoms absorb it. To make a clock from this setup, we then simply count cycles of the oscillator; the duration of a certain number of cycles defines a unit of time, for example, the second. Today, the most accurate clocks count cycles of radiation corresponding to optical wavelengths, around a million billion per second. To achieve high accuracy, many interesting effects, including those due to Einstein's relativity, must be accounted for.