Kurt Gibble is an Associate Professor of Physics at Penn State. He is best known for his work on Rubidium clocks and for atom-juggling experiments. His research focuses on atomic clocks and the scattering of ultra-cold atoms.

"Atomic Clocks: How they work and why we need them."

I will explain how an atom in an atomic clock can tell time and what makes it tick. Atomic clocks perform the most accurate measurements and the accuracy enables a number of prolific technologies ranging from navigation systems such as the Global Position System (GPS) to high-speed fiber-optic networks. Currently, the best clocks use lasers to cool atoms to within a millionth of a degree of absolute zero. At such low temperatures, quantum mechanics dictates that the atoms interact like waves. This limits the accuracy of the clocks and is leading us to atomic clocks based on different atoms. The next generation of atomic clocks will be based on optical instead of microwave frequencies. Every clock has two key components: a very stable frequency and a mechanism to count that frequency. The 2005 Nobel Prize in Physics was awarded to John Hall and Theodore Hansch for their innovations that allow us to count the cycles of optical frequencies. I will describe these recent and incredible innovations and how they will lead to atomic clocks with unprecedented accuracy.