This course, 228h, will take you on a voyage of discovery through 20th century physics. At the beginning of the 20th c., no scientist, even in their wildest dreams, could have imagined the revolution ahead. The discovery of atoms and particles, the idea of space-time, the equivalence of matter and energy, the wave nature of particles & the particulate nature of light waves, semiconductors, superconductors, the accelerating universe. All these are part of a scientific revolution that continues today, and whose consequences are rapidly transforming our world and impacting your lives.
We will discuss & learn some of the key concepts behind this revolution. A big part of our work will be the study of waves. Light, and amazingly, matter also, is made up of waves. Each atom in your body contains electrons trapped as tiny standing waves. This is where we will begin: with the study of waves — with the physics of light, that we call "optics". From light, we will go onto study relativity, then to study the quantum wave nature of matter. We will then take a tour that takes us down, down, down in scales to the electronic, nuclear and ultimately the quark structure of matter. We will end with a discussion of cosmology.
photon, electron

Bohr atom

Schrödinger picture of the $\text{H}_2$ molecule

Laser
(Myriads of photons in perfect phase coherence)