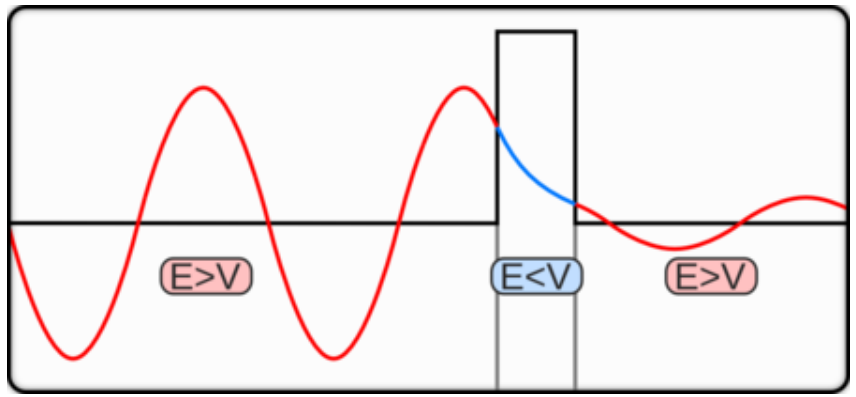
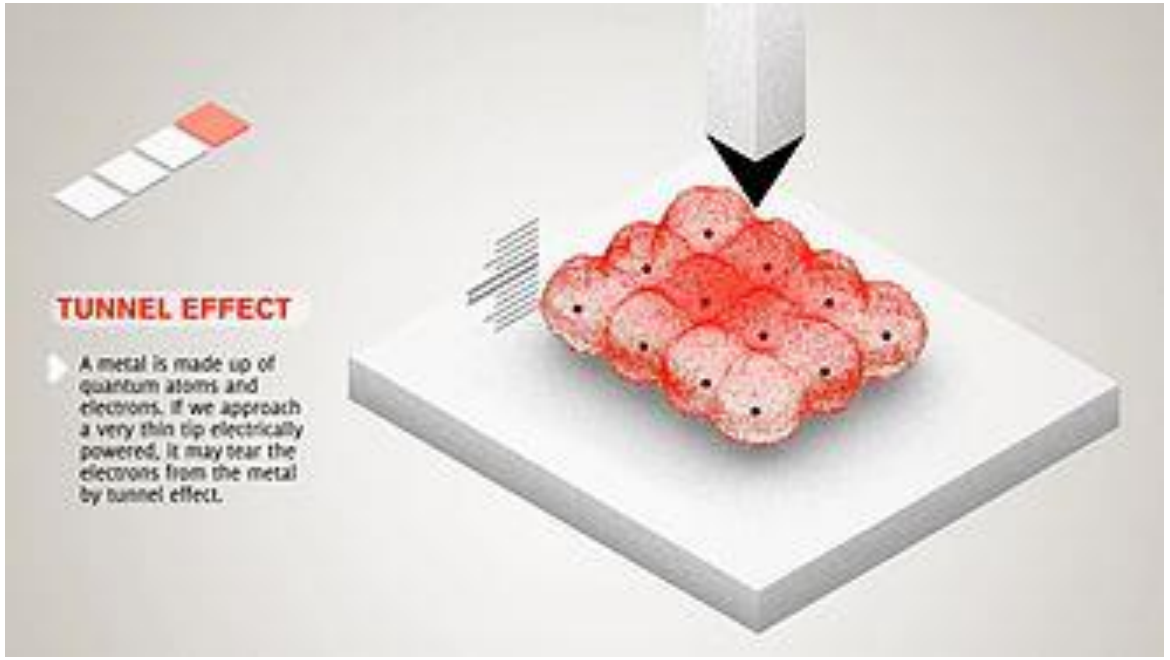
Quantum Tunnelling

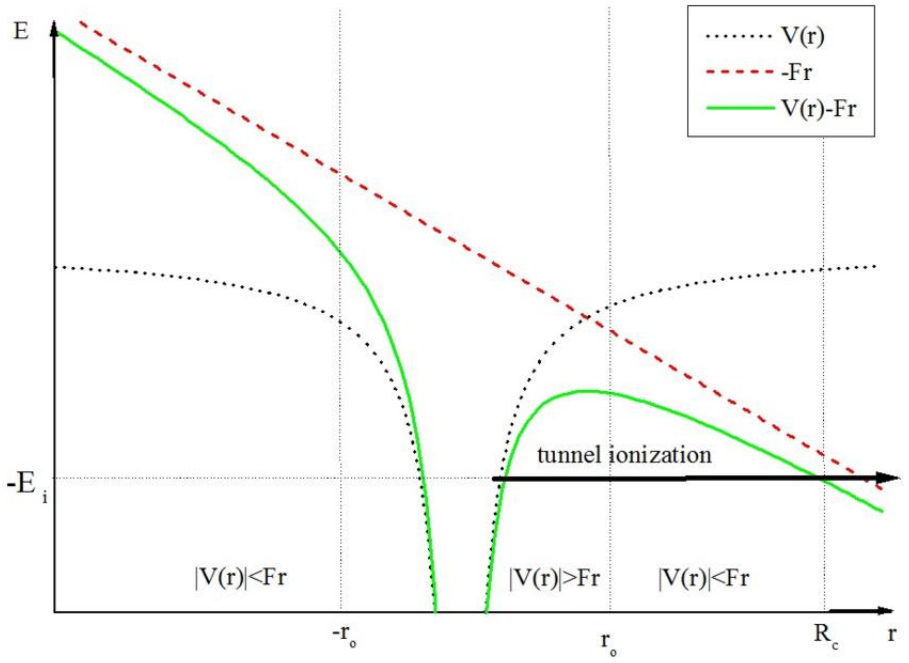


Tunnelling through a finite barrier is an intrinsically quantum phenomenon, but is widespread in nature and technology

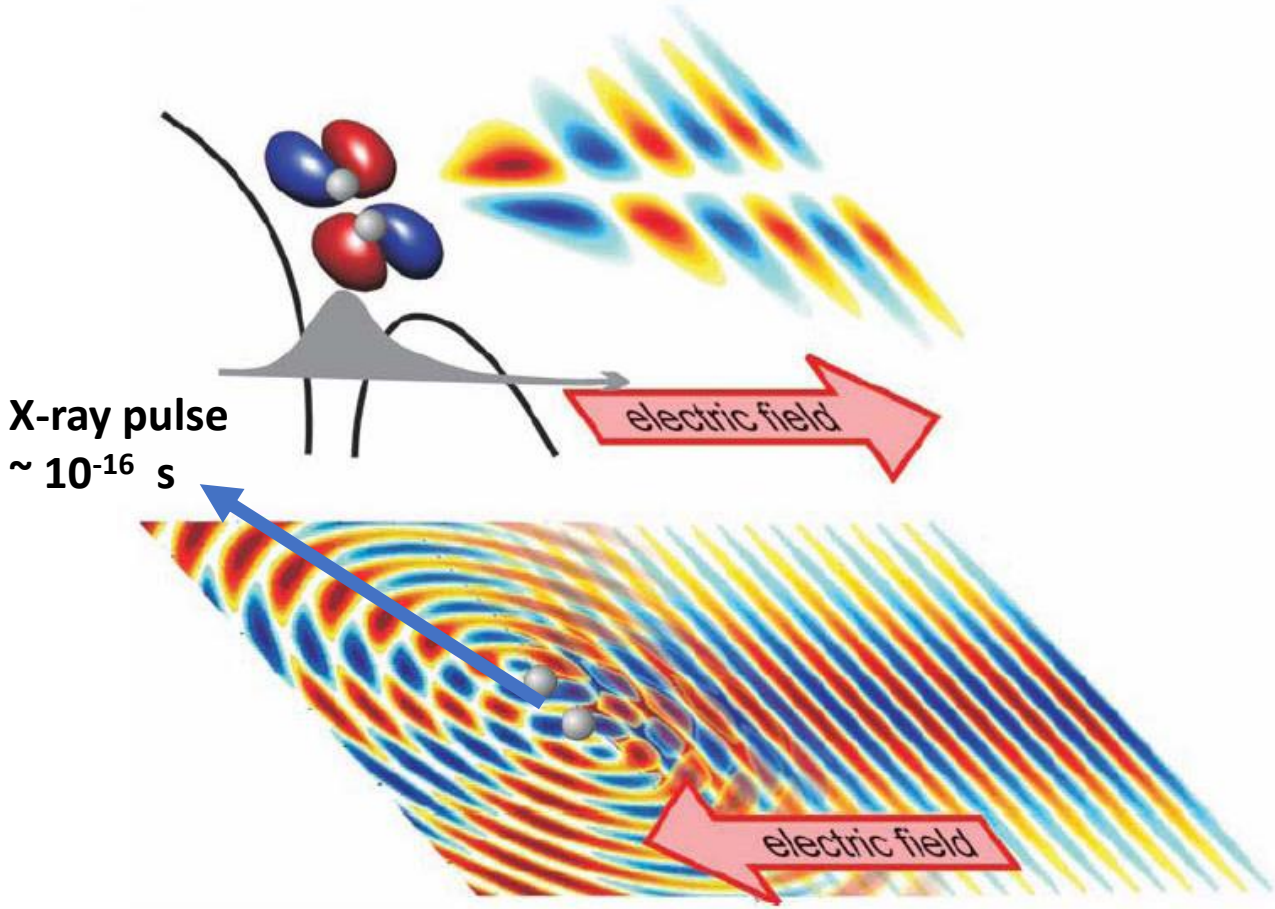


It is the basis of the Scanning Tunnelling Microscope (STM).
In this device as an atom scale tip is scanned across a surface the tunnelling current is modulated by the atomic scale features, thus mapping the surface with atomic resolution.
(Invention awarded the Nobel prize in 1986)

Tunnelling is also important in laser physics



A strong laser fields periodically distorts the Coulomb potential creating a finite barrier through which tunnelling occurs every ½ cycle of the laser



The duration of the tunnel current is typically ~ 10^{-16} s and can give rise to sub-fs pulses of X-rays perfectly synchronized to the laser field

The field of attosecond science is emerging from this capability