PC3130

Quantum Mechanics II

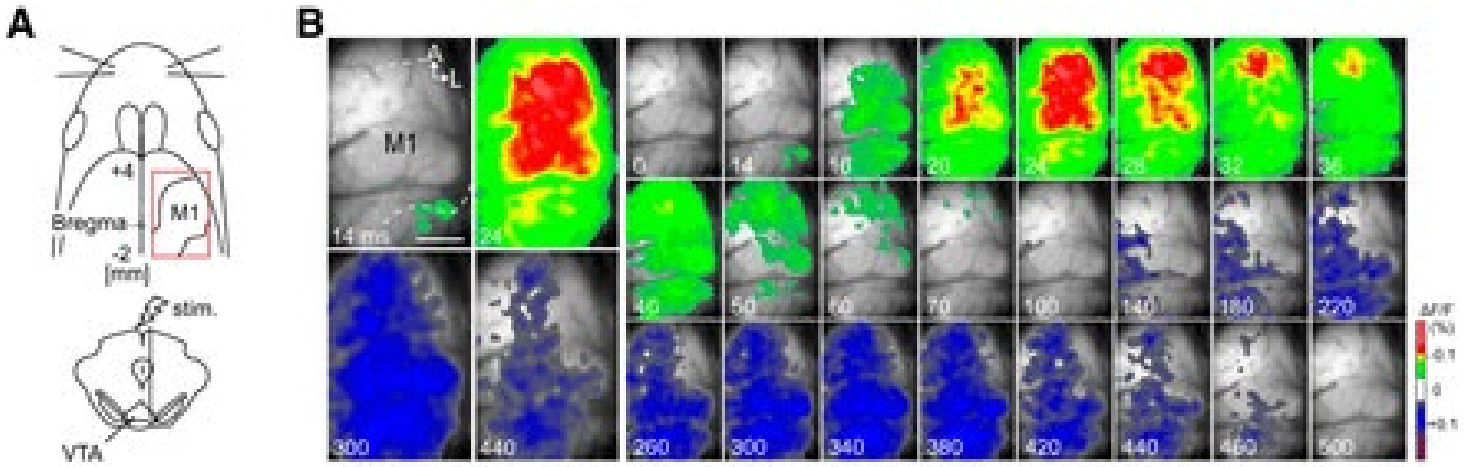
Time-Independent Perturbation Theory

Some motivation

Stark Effect

How does an external electric field change the energy levels and optical transitions?

Voltage-sensitive dyes used to map the spatial and temporal profile of neuron firing activity in Part M1 of the brain, following a stimulation in another part of the brain (VTA).



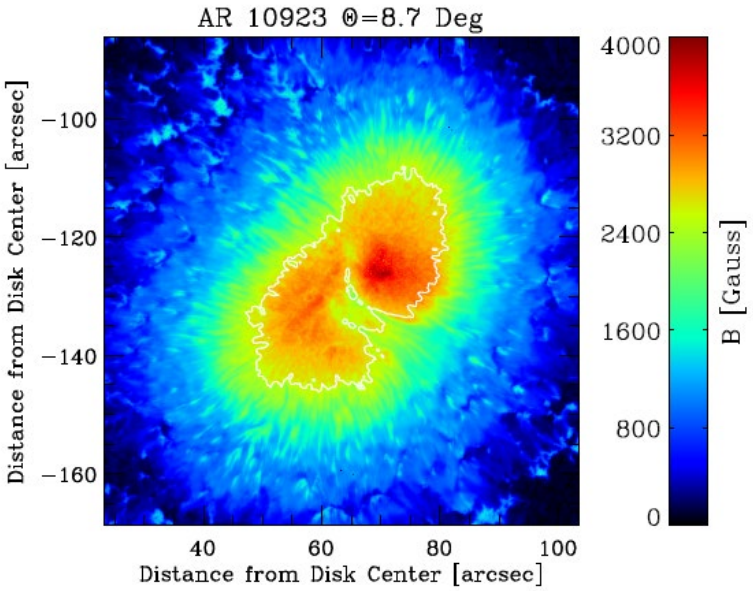
Journal of Neuroscience 34, 8894 (2014)

Some motivation

Zeeman Effect

How does an external magnetic field change the energy levels?

Earth's magnetic field ~ 0.3 Gauss



Large magnetic fields measured at sunspots (deduced using the Zeeman effect)

Living Rev. Solar Phys., 8, (2011), 4

Atomic Fine structure and Hyperfine structure

Besides the Coulomb potential, other naturally occurring terms in the atomic Hamiltonian cause small changes to the energy levels.

The SI unit of time, one second, is defined by taking the fixed numerical value of the cesium frequency $\Delta\nu_{Cs}$, the unperturbed ground-state hyperfine transition frequency of the cesium-133 atom, to be 9,192,631,770 when expressed in the unit Hz, which is equal to s^{-1}.