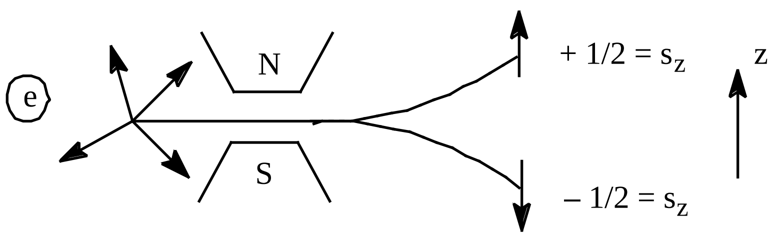
**QUANTUM MECHANICAL MEASUREMENT**

**CHEMISTRY 163A**

According to the postulates of quantum mechanics: *when a measurement device acts on a system, the result of measurement is one of the eigenvalues of the operator representing the measurement property* (the property the measurement device is determining).

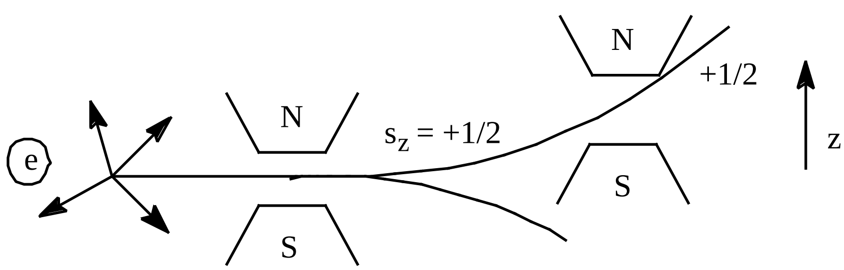
In the Stern-Gerlach experiment which showed electron spin is quantized we would have the following situation:




random orientation of spin

magnet

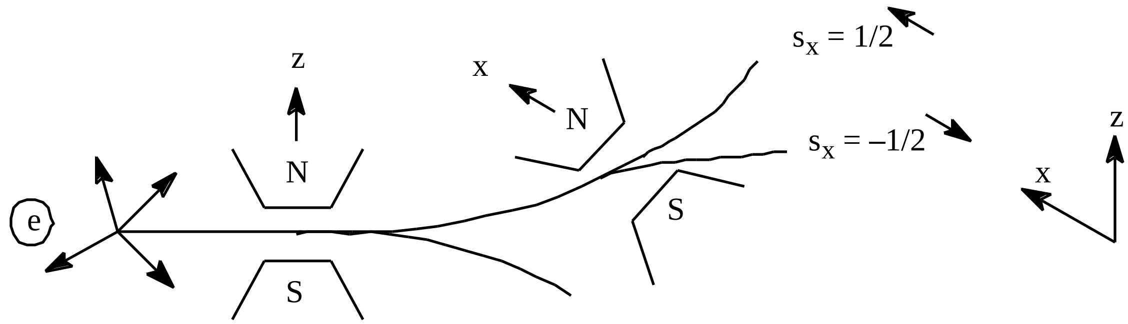
magnet gives two beams where individual electrons assume $s_z = 1/2$ or $s_z = -1/2$, the *eigenvalues* of $s_{zop}$ as measured by a magnet with magnetic field in z-direction. The incoming electrons are, on average, an equal combination of $s_z = 1/2$ and $s_z = -1/2$.




When the $s_z = 1/2$ beam is put into a second magnet with magnetic field in z-direction only *one* beam exits. This is because all the electrons coming in are "prepared" in the $s_z = 1/2$ *eigenstate* of the second magnet.

So far so good!

*However:*




if the $s_z = +1/2$ beam is put into a magnet with field *in the x-direction* this beam is again separated into *two beams*: $s_x = +1/2$, $s_x = -1/2$. This is because the *eigenstates* of measurement using this magnet have $s_x = +1/2$ and $s_x = -1/2$ *and* the incoming beam with $s_z = +1/2$ is an equal combination of $s_x = +1/2$, $s_x = -1/2$.

Hmmm!! Some deep thought!

We will be doing an in-class "lab" with polarized photons to illustrate measurement.