

Answer on Question #57993, Physics / Atomic and Nuclear Physics

In Stern Gerlach experiment, why should one use neutral atoms instead of ions? If one performs the experiment with an atom of total angular momentum J , how many lines will be obtained?

Answer:

Atoms of silver was used in experiments. Silver - chemical element of the first group Mendyelyev table. Chemical elements of the first group have one valence electron. Therefore, magnetic moment of the atom equals to a magnetic moment of one valence electron.

Ion - an atom that has lost one electron (positively charged ion) or gained one electron (negatively charged ion). And therefore ion not have one valence electron.

A beam of silver atoms placed in an inhomogeneous magnetic field. Silver atoms are electroneutral and Ampere force not acted on them. Ions are not electrically neutral and Ampere force would act on them.

The experiment showed that in the presence of a magnetic field on the screen appeared two spots. Split beam explains that the magnetic moment of an atom can have two orientations: parallel to the lines of the magnetic field or antiparallel to the magnetic field lines. Explanation: electron have the mechanical and magnetic spins.