Exercises — Theme 1

Exercise 1 : Stern–Gerlach and the idea of quantization

Keywords: Stern–Gerlach, spin, measurement postulate, experiment

Question. A beam of atoms crosses a Stern–Gerlach device along z; the "spin-up" component is kept. That sub-beam enters a second device, also along z. What is seen on the screen?

Hint

Think about repeating a projective measurement in the same basis.

Solution

The atoms were already projected onto $|+_z\rangle$; the second filter does not split that component further: a single spot, consistent with the preparation.

Question. Same preparation, but the second device is along x. What happens?

Solution

$|+_z\rangle$ expands in the x basis with two nonzero components; two spots appear, each with probability 1/2 (barring degenerate magnet alignment).