

System of two spin- $\frac{1}{2}$ particles

Small white board questions:

1. The electron has spin $\frac{1}{2}$, with spin up and spin down eigenstates $|\pm\rangle_e$. For the electron, use the symbol S for the spin S_e .

Write down the eigenvalue equations for the electron states.

2. The proton has spin $\frac{1}{2}$, with spin up and spin down eigenstates $|\pm\rangle_p$. For the proton, use the symbol I for the spin S_p .

3. Write down the eigenvalue equations for the proton states.

4. The system of electron and proton could be in the state:

$$|e^- up\rangle|p^+ up\rangle = |+\rangle_e|+\rangle_p \equiv |++\rangle$$

Using the compact $|++\rangle$ notation, what are the possible spin states of the electron-proton system?

Large white board activities:

1. Find the matrix representation of the electron spin component operator S_z .
2. Find the matrix representation of the proton spin component operator I_z .