

## 23.6: Postulate 6- Pauli Exclusion Principle

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The total wave function of a system with  $N$  spin- $\frac{1}{2}$  particles (also called **fermions**) must be antisymmetric with respect to the interchange of all coordinates of one particle with those of another. For spin-1 particles (also called **bosons**), the wave function is symmetric:

$$\begin{aligned}\Psi(\mathbf{r}_1, \mathbf{r}_2, \dots, \mathbf{r}_N) &= -\Psi(\mathbf{r}_2, \mathbf{r}_1, \dots, \mathbf{r}_N) && \text{fermions,} \\ \Psi(\mathbf{r}_1, \mathbf{r}_2, \dots, \mathbf{r}_N) &= +\Psi(\mathbf{r}_2, \mathbf{r}_1, \dots, \mathbf{r}_N) && \text{bosons.}\end{aligned}$$

Electronic spin must be included in this set of coordinates. As we will see in [chapter 26](#), the mathematical treatment of the antisymmetry postulate gives rise to the Pauli exclusion principle, which states that two or more identical fermions cannot occupy the same quantum state simultaneously (while bosons are perfectly capable of doing so).

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