

Spin spherical harmonics

In quantum mechanics, **spin spherical harmonics** $Y_{l, s, j, m}$ are spinors eigenstates of the total angular momentum operator squared:

$$\begin{aligned}\mathbf{j}^2 Y_{l, s, j, m} &= j(j+1) Y_{l, s, j, m} \\ \mathbf{j}_z Y_{l, s, j, m} &= m Y_{l, s, j, m}\end{aligned}$$

where $\mathbf{j} = \mathbf{l} + \mathbf{s}$. They are the natural spinorial analog of vector spherical harmonics.

For spin-1/2 systems, they are given in matrix form by^[1]

$$Y_{j \pm \frac{1}{2}, \frac{1}{2}, j, m} = \frac{1}{\sqrt{2(j \pm \frac{1}{2}) + 1}} \begin{pmatrix} \mp \sqrt{j \pm \frac{1}{2} \mp m + \frac{1}{2}} Y_{j \pm \frac{1}{2}}^{m - \frac{1}{2}} \\ \sqrt{j \pm \frac{1}{2} \pm m + \frac{1}{2}} Y_{j \pm \frac{1}{2}}^{m + \frac{1}{2}} \end{pmatrix}$$

Notes

- ↑ Biedenharn, L. C.; Louck, J. D. (1981), *Angular momentum in Quantum Physics: Theory and Application*, Encyclopedia of Mathematics, **8**, Reading: Addison-Wesley, p. 283, ISBN 0-201-13507-8

References

- ↑ Edmonds, A. R. (1957), *Angular Momentum in Quantum Mechanics*, Princeton University Press, ISBN 978-0-691-07912-7

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