Oblig 11

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Problem 11.1 (L)

$$A = uL^2 + \hbar v L^z$$
$$L^2 = \hbar^2 l(l+1) \quad , \quad L^z = \hbar m$$

Acting on the general state with our operator A:

$$A\,|nlm\rangle = \left(u\hbar^2 l(l+1) + \hbar^2 vm\right)|nlm\rangle$$

We have shown that $|nlm\rangle$ is an eigenstate of A. To be a good state, it must also be an eigenstate of the full Hamiltonian H:

$$H = A + H^1 = uL^2 + \hbar v L^z - \frac{\vec{p}^4}{8m^3c^2}$$

Acting on the same general state yields:

$$H\,|nlm\rangle = \left(u\hbar^2 l(l+1) + \hbar^2 vm - \frac{\vec{p}^4}{8m^3c^2}\right)|nlm\rangle$$

This shows how even when adding the perturbation H^1, the state $|nlm\rangle$ is still an eigenstate of the full Hamiltonian H.

Problem 11.7 (X)

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