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Abstract

Fisher Information of Landau States and Relative Information against the Lowest Level †

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An electron in a constant magnetic field has the energy levels known as the Landau levels. One can obtain the corresponding radial wave function in cylindrical polar coordinates (e.g., textbook of Landau & Lifshitz). This system is not explored so far in terms of information-theoretical point of view. We here focus on Fisher information associated with these Landau states specified by the two quantum numbers. Fisher information provides a useful measure of the electronic structure in quantum systems such as hydrogen-like atoms [1,2] and molecules under Morse potentials [3]. We numerically evaluate the generalized Laguerre polynomials contained in the radial wave functions. We report that Fisher information increases linearly with the quantum number n that specifies energy levels, but decreases monotonically with the quantum number m (i.e., the index of the generalized Laguerre polynomial).

Also, we present relative Fisher information of the Landau states by setting the lowest Landau state as a reference density. The analytical form is just 4n, which does not depend on the other quantum number m.

References

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