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Moments of inertia of paring rotation calculated with BCS model for the pairing Hamiltonian

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Among open-shell nuclei, systematic difference is found in ground-state energies between odd-even and even-even nuclei.
This is because the pairing interaction lowers the ground-state energy of even-even nuclei.
If we focus on the second-order terms of expansion of the ground-state energy with respect to the neutron number difference from one nuclide, nuclei in an isotopic chain may form a pairing rotational band.
Experimentally measured energies are also supporting the interpretation of this pairing rotational band.
The pairing correlations could lead to the breaking of the gauge symmetry.
The state has a specific orientation in the gauge space because of the spontaneous breaking of the gauge symmetry. As a result, it has a new rotational degree of freedom and a moment of inertia.

For a simple model of Sn isotopes, I adopt the BCS model for the pairing Hamiltonian and study the pairing rotational bands and their moments of inertia.
Next, I perform the particle-number projection of the obtained BCS states to obtain particle-number eigenstates.
In order to determine the pairing strength G, I study the dependence of the moments of inertia on G, then examine whether the pairing rotational bands and the moment of inertia are reproduced with the projected states.

Experimental study on nuclear physics

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