Spin-Isospin Modes in Diffracted Fringes of Neutron Resonance Spectra

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We can observe spin-isospin modes in neutron resonance spectra by constructing diffracted fringes in the energy-phase diagrams.

We found that resonance energies contain phases of periodic sequences with respect to zero neutron energy, neutron binding energy of the compound nucleus. In the energy-phase diagrams, groups of observed resonance energies for medium and heavy nuclei can form parabolic fringes. These fringes are interpreted as an assembly of points where phases match both for incident neutron periodic sequences and internal oppositely-running quasiparticles. Observed sets of diffracted fringes have such multiple structure that its members are spaced with dicrete fractional intervals along the phase axis. Parabolic fringes appear for the resonances with separate spin or mixed spins.

One set of diffracted fringes covers an energy range of several ten to several hundred times the average level spacing. Therefore, contrary to a seemingly chaotic behavior of level occurrences, neutron resonance levels on the same set of diffracted fringes are an aggregate mutually correlated.

In this paper we describe the mutual conversion of diffracted fringes into separate spin and mixed spins depending on the fractional values of the period. Typical examples are presented for the ^{235}U nucleus.