Integer Ratios in Resonance Energies of the Compound Nucleus based on Time Coherency at Resonances

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Abstract

For an isolated neutron resonance, time coherency is required by S-matrix theory between incident wave and the response function of the compound nucleus. Dynamical behaviors of the compound nucleus, assumed to be decomposed into many normal modes, must fulfil the time boundary condition determined by the period of the de Broglie frequency of the incident neutron wave. The energies of these normal modes are restricted to be commensurable (integer ratios) with each other. Integer rations among E_x, E_n^* and $S_n(= E_x - E_n^*)$ are deduced from these relations. Also, among resonance energies of the same nucleus, integer ratios are expected. Excitation energies E_x are written as a sum of inverse integers: $E_x = G\sum \frac{1}{n}$, where n=integers, and G=34.5MeV(preliminary). The time periods of the normal modes are integer multiples of $\tau_0 = 2\pi\hbar/G = 1.20 \times 10^{-22}s$.
Ratios E_x/S_n are tabulated for resonances of light nuclei and ^{208}Pb. Neutron resonance reaction mechanism is discussed.