Decay out of a superdeformed band

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We derive analytic formulae for the energy average (including the energy average of the fluctuation contribution) and variance of the intraband decay intensity of a superdeformed band. Our results may be expressed in terms of three dimensionless variables: $\Gamma^{\downarrow}/\Gamma_S$, Γ_N/d and $\Gamma_N/(\Gamma_S+\Gamma^{\downarrow})$. Here $\Gamma^{\downarrow}$ is the spreading width for the mixing of a superdeformed (SD) state $|0\rangle$ with the normally deformed (ND) states $|Q\rangle$ whose spin is the same as $|0\rangle$'s. The $|Q\rangle$ have mean lever spacing d and mean electromagnetic decay width Γ_N whilst $|0\rangle$ has electromagnetic decay width Γ_S. The average decay intensity may be expressed solely in terms of the variables $\Gamma^{\downarrow}/\Gamma_S$ and Γ_N/d or, analogously to statistical nuclear reaction theory, in terms of the transmission coefficients $T_0(E)$ and T_N describing transmission from the $|Q\rangle$ to the SD band via $|0\rangle$ and to lower ND states. The variance of the decay intensity, in analogy with Ericson's theory of cross section fluctuations, depends on an additional variable, the correlation length $\Gamma_N/(\Gamma_S+\Gamma^{\downarrow}) = \frac{d}{2\pi}T_N/(\Gamma_S+\Gamma^{\downarrow})$ [1]. This suggests that analysis of an experimentally determined variance could yield the mean level spacing d as does analysis of the cross section autocorrelation function in compound nucleus reactions. We also discuss the importance of the chaoticity of the ND states with regard to the decay out mechanism [3, 4].

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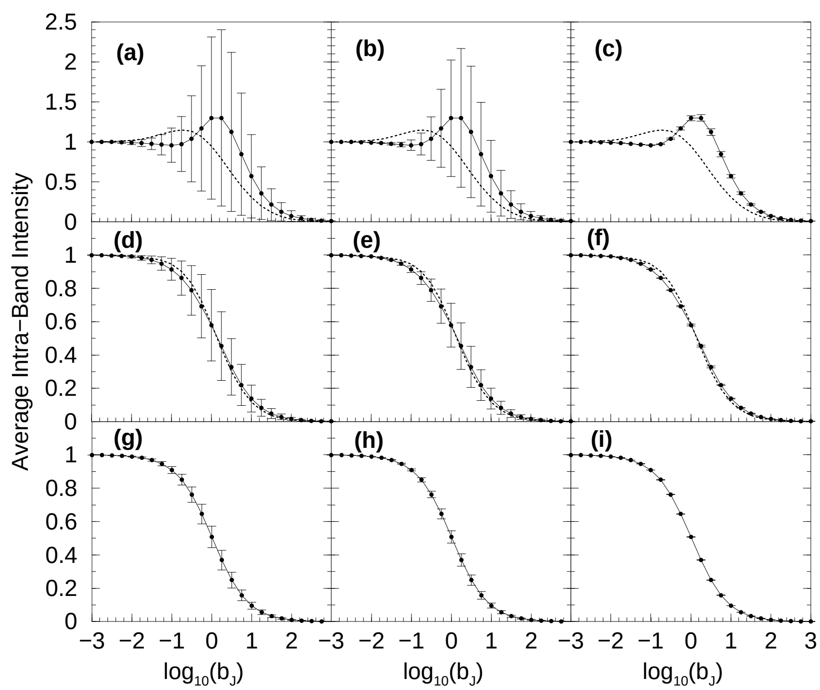

FIG. 1: The average intraband intensity vs. $\log_{10}(b_J)$ where $b_J \equiv \Gamma^{\downarrow}/\Gamma_S$ and it's variance (the error bars) both calculated as in Ref. [1]. The dotted lines were calculated using a fit formula from Ref. [2]. The variable Γ_N/d took the following values: 0.1 in graphs (a), (b) and (c); 1 in graphs (d), (e) and (f); 10 in graphs (g), (h) and (i). The variable $\Gamma^{\downarrow}/\Gamma_N$ took the following values: 10^{-3} in graphs (a), (d) and (g); 1 in graphs (b), (e) and (h); 10^3 in graphs (c), (f) and (i).