Investigation of E0 transitions in nuclei at the transitional point between spherical and deformed shapes *

Andreas Krugmann

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- Motivation
- Theoretical background
- Model predictions
- Experiment @ S-DALINAC

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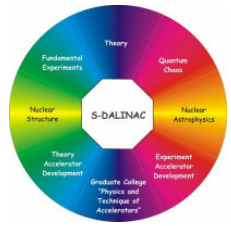

*Supported by the DFG within SFB 634

Motivation

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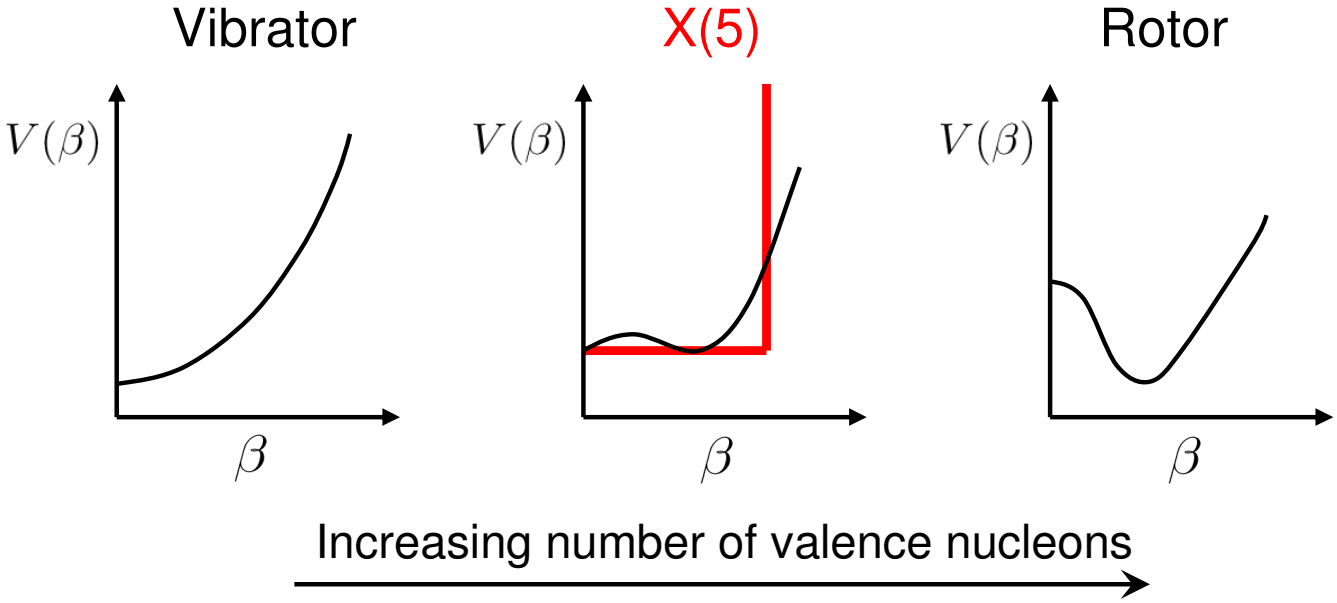
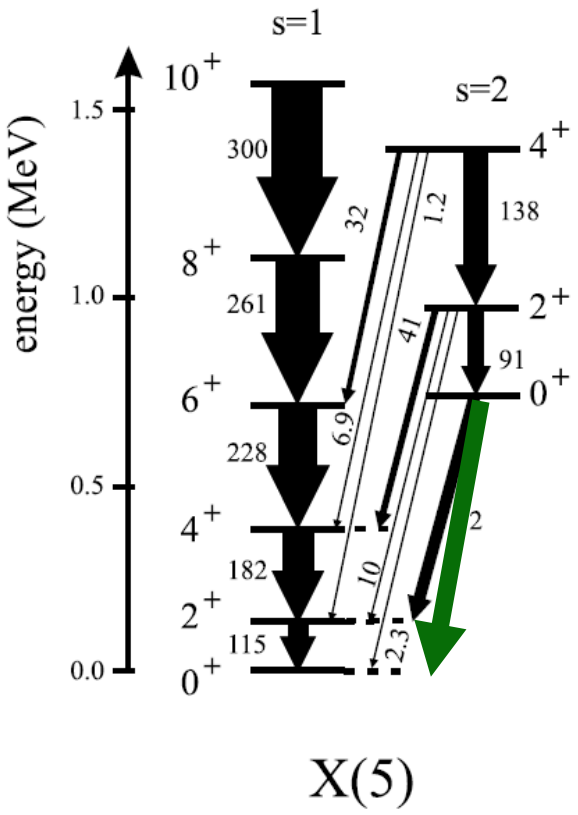
- Geometrical collective model: Solution of Bohr Hamiltonian

$$H = -\frac{\hbar^2}{2B}\left[\frac{1}{\beta^4}\frac{\partial}{\partial\beta}\beta^4\frac{\partial}{\partial\beta} + \frac{1}{\beta^2\sin 3\gamma}\frac{\partial}{\partial\gamma}\sin 3\gamma\frac{\partial}{\partial\gamma} - \frac{1}{4\beta^2}\sum_k \frac{Q_k^2}{\sin^2\left(\gamma - \frac{2}{3}\pi k\right)}\right] + V(\beta,\gamma)$$

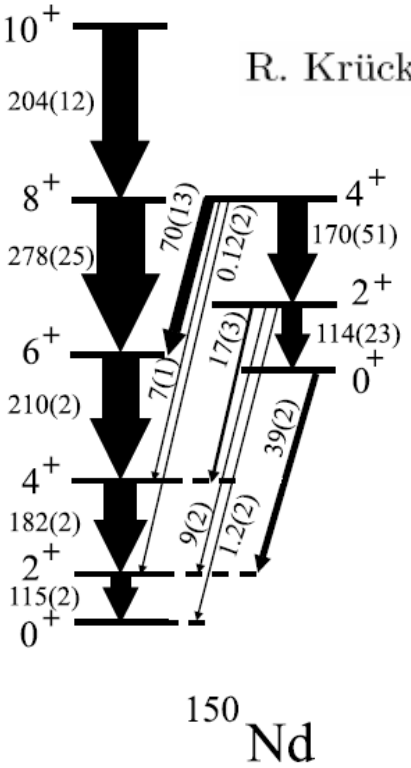
- Nuclei at transitional region between vibrator and rotor (N ≈ 90)



Motivation



X(5)



^{150}Nd

R. Krücken, et al., Phys. Rev. Lett. **88**, 232501 (2002)

- Large E2 intraband transitions
- Large E0 interband transitions?

Confined β-Soft Rotor Model

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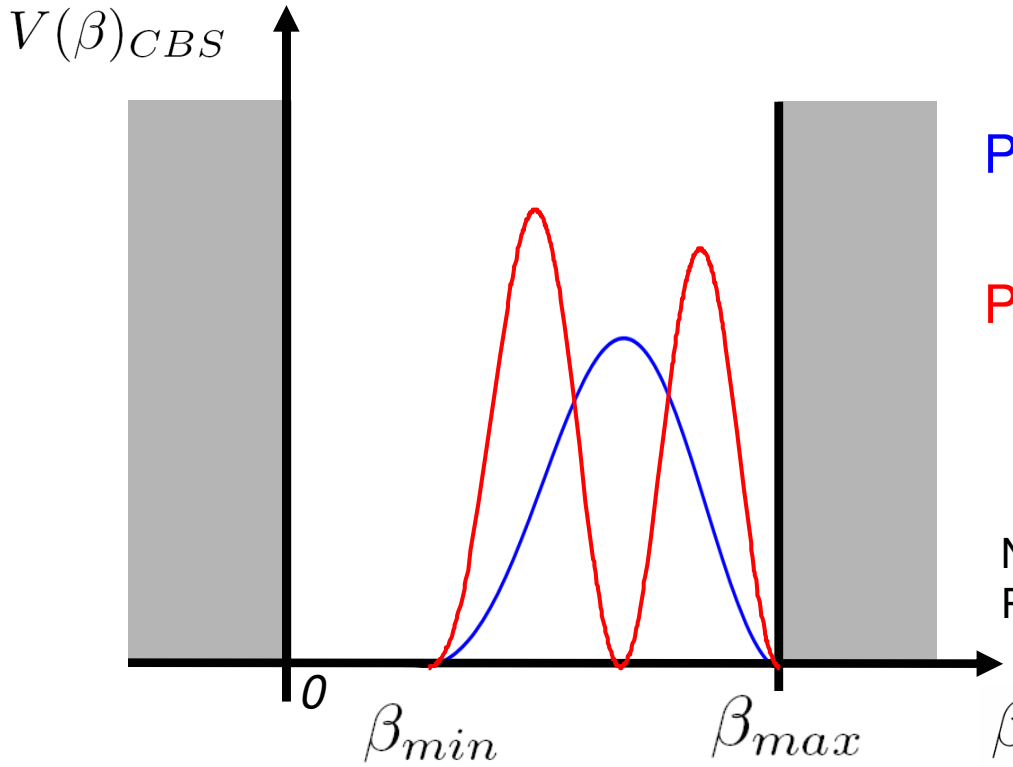

Probability density distribution of g.s.

Probability density distribution of 0^+_2 state

N. Pietralla and O. Gorbachenko,
Phys. Rev. C **70**, 011304(R) (2004)

- Analytical wave functions in deformation coordinate β
- Very good description of B(E2) strengths & g.s. band energies in transitional nuclei
- Prediction for E0 transition strengths

E0 Transitions

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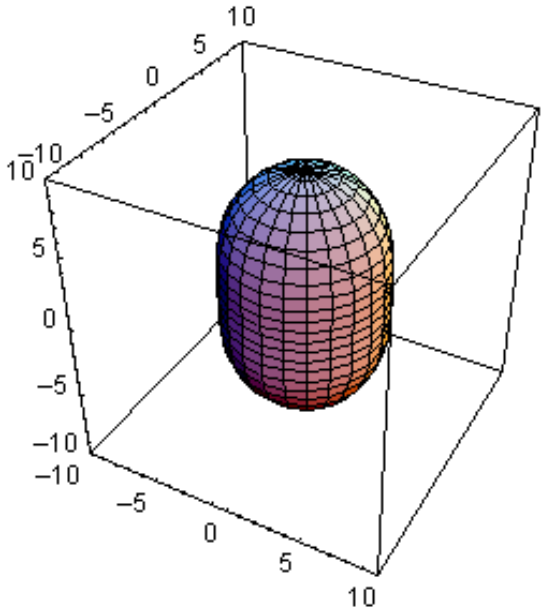
- CBS Model predicts large E0 transition strengths $\rho^2(E0; 0^+_{gs} \rightarrow 0^+_{\beta})$
- Direct evidence for β-vibration?



- Observable:

Transition matrix element

$$\rho(E0; i \rightarrow f) = \frac{\langle f \mid M(E0) \mid i \rangle}{eR^2}$$

Planned Experiment @ S-DALINAC

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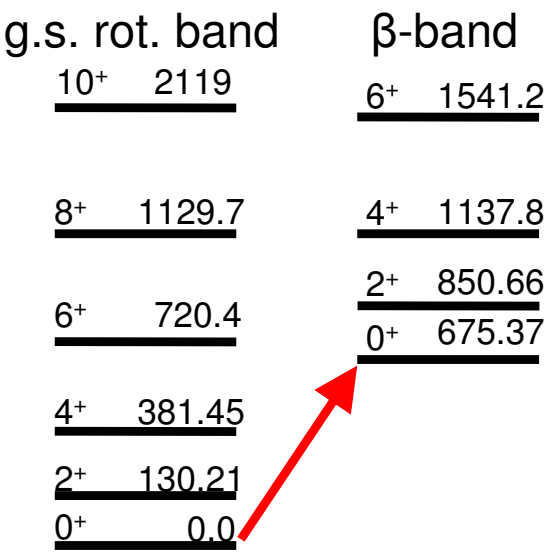
- Excitation of 0^+_2 state in ^{150}Nd via inelastic electron scattering



CBS Predictions for ^{150}Nd: E(0; $0^+_1 \rightarrow 0^+_\beta$)

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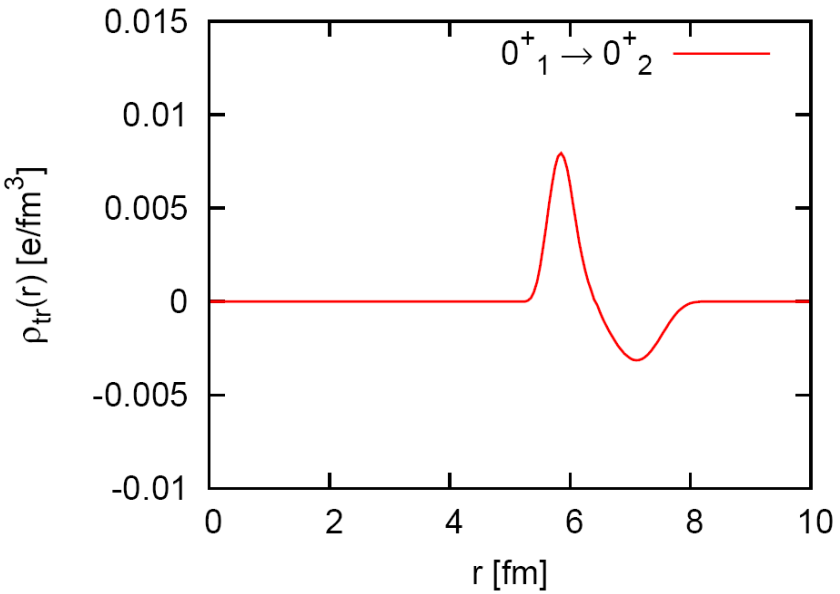
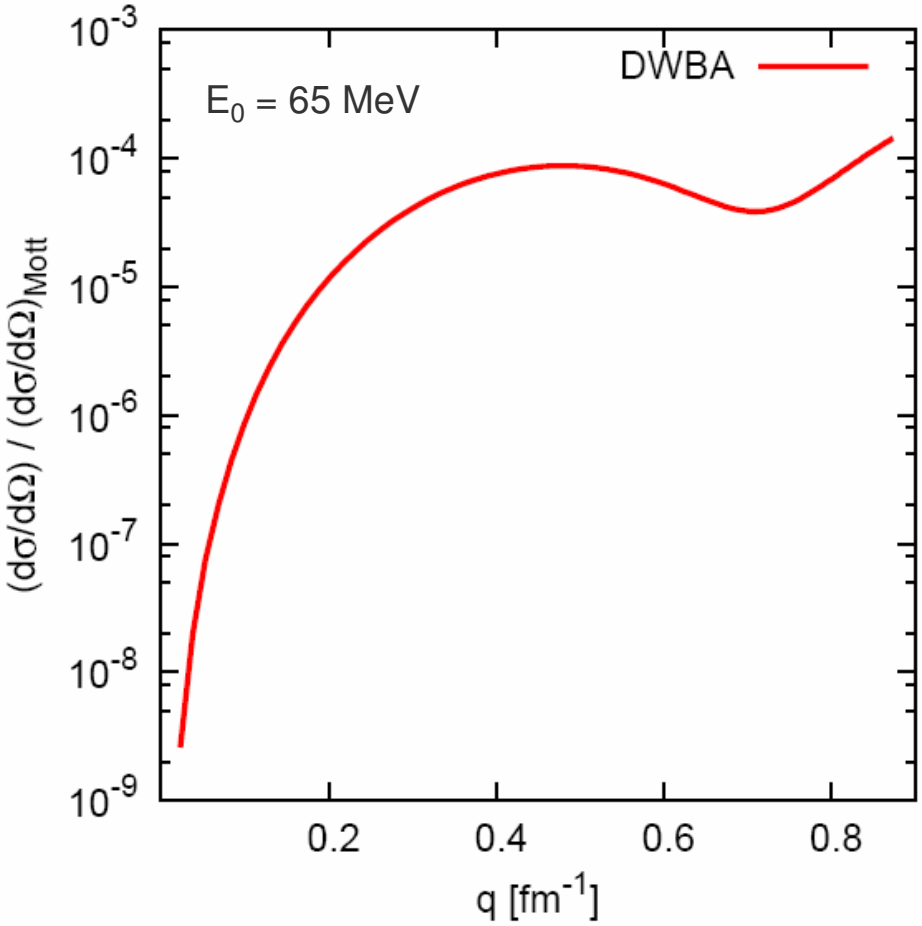
Transition charge density



Form factor



Calculated E0 transition strength:

$\rho^2(E0)_{CBS} = 110 \cdot 10^{-3}$

Sensitivity for E0 Transition Strengths in (e,e‘)

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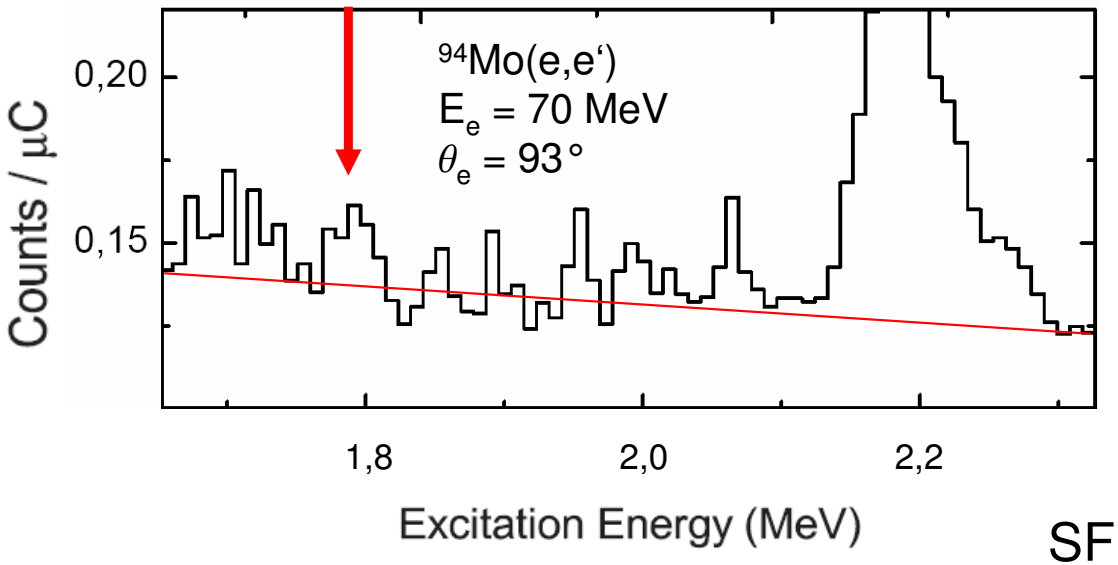
- Sensitivity test for ^{150}Nd Experiment
- ^{94}Mo data set (similar mass and kinematics)
- Analysis of 0^+_2 state
- Upper threshold for E0 transition strength estimated $\rho^2(E0) \sim 7 \cdot 10^{-3}$



Ready for Experiment!

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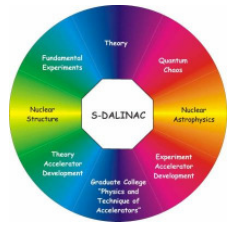

End of A2 Session

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Kaffeepause