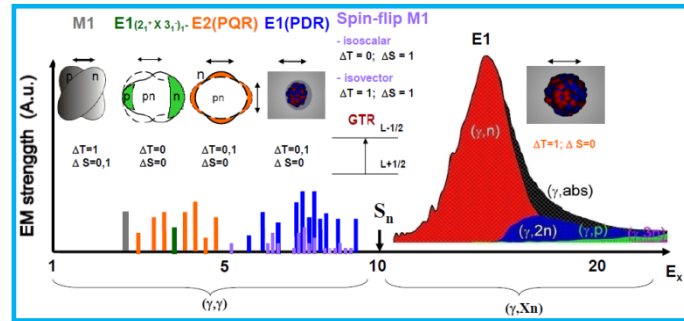# Microscopic Description of Astrophysical Processes

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Low-Energy Nuclear Excitations and Astrophysical Reaction Rates
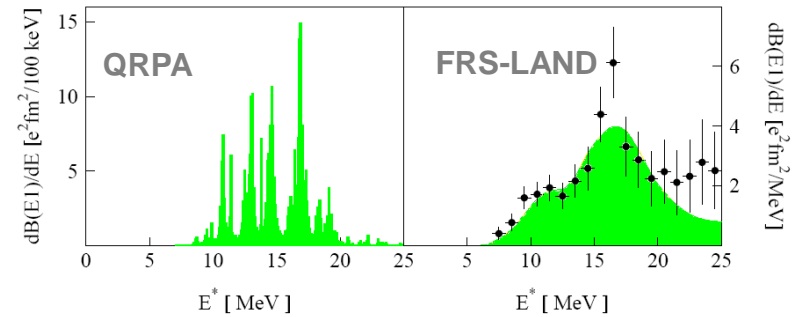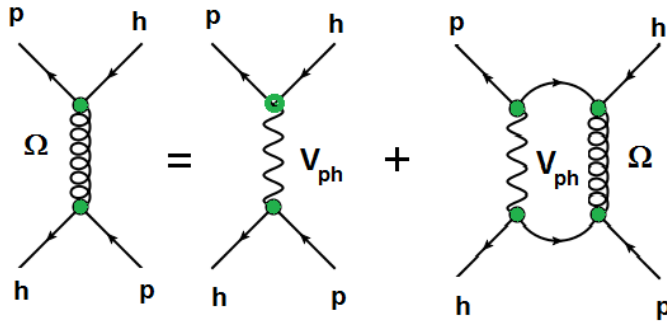

NEUTRON CAPTURE CROSS SECTIONS of the ^{85}Kr(n,γ)^{86}Kr, ^{87}Sr(n,γ)^{88}Sr, ^{89}Zr(n,γ)^{90}Zr and ^{91}Mo(n,γ)^{92}Mo reactions calculated with TALYS using EDF+QRPA, HFB+QRPA and three-phonon QPM strength functions.

N. Tsoneva, S. Goriely, H. Lenske, R. Schwengner, Phys. Rev. C 91, 044318 (2015).
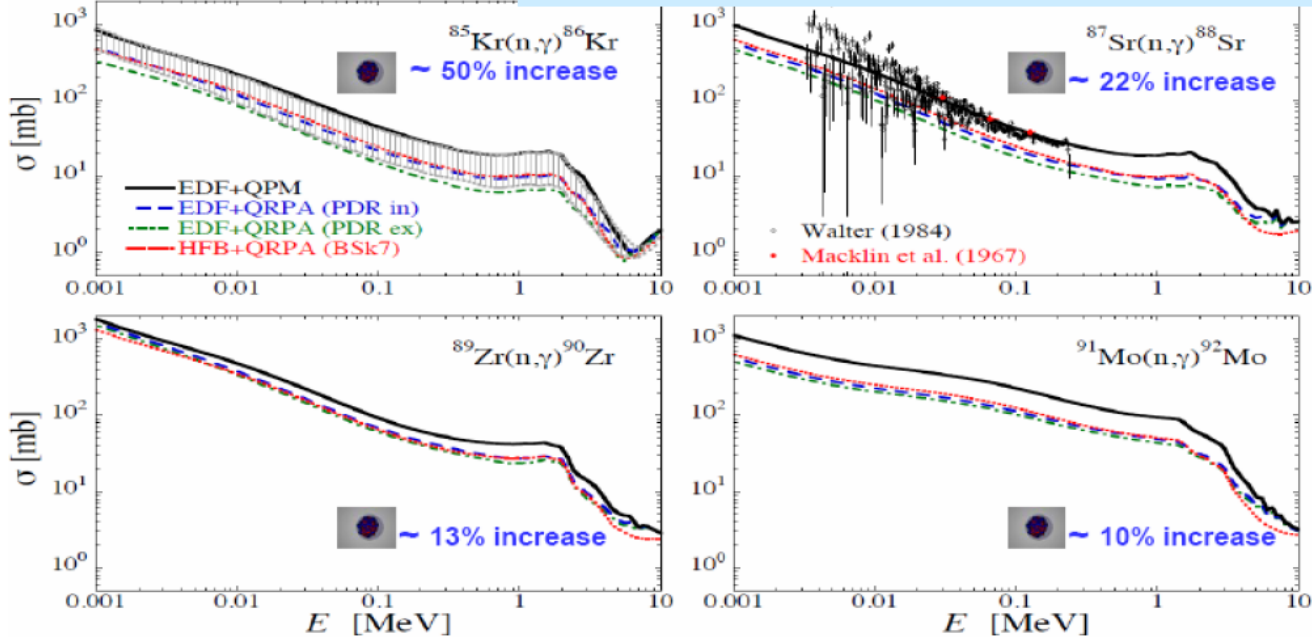
The Giessen Approach: Predictive Power by DFT and QPM

- **EDF:** $E(\rho)=E_{kin}(\rho) +\frac{1}{2} E_{int}(\rho)$

- $\delta E(\rho) \rightarrow$ **HFB:** $\left(T_q + U_q(\rho)+\Delta_q(\rho)-\varepsilon_q\right)\varphi_q = 0$

- $\delta^2 E(\rho) \rightarrow$ **QRPA:** $\delta^2 E(\rho) \rightarrow \sum_{q,q'=p,n} f_{qq'}(\rho)\delta\rho_q\delta\rho_{q'}$

- **Anharmonicities:**

$$|\Psi\rangle = \sum_{abc}\left[X_a + X_{ab} + X_{abc}\right]$$