Nuclear level density Discussion

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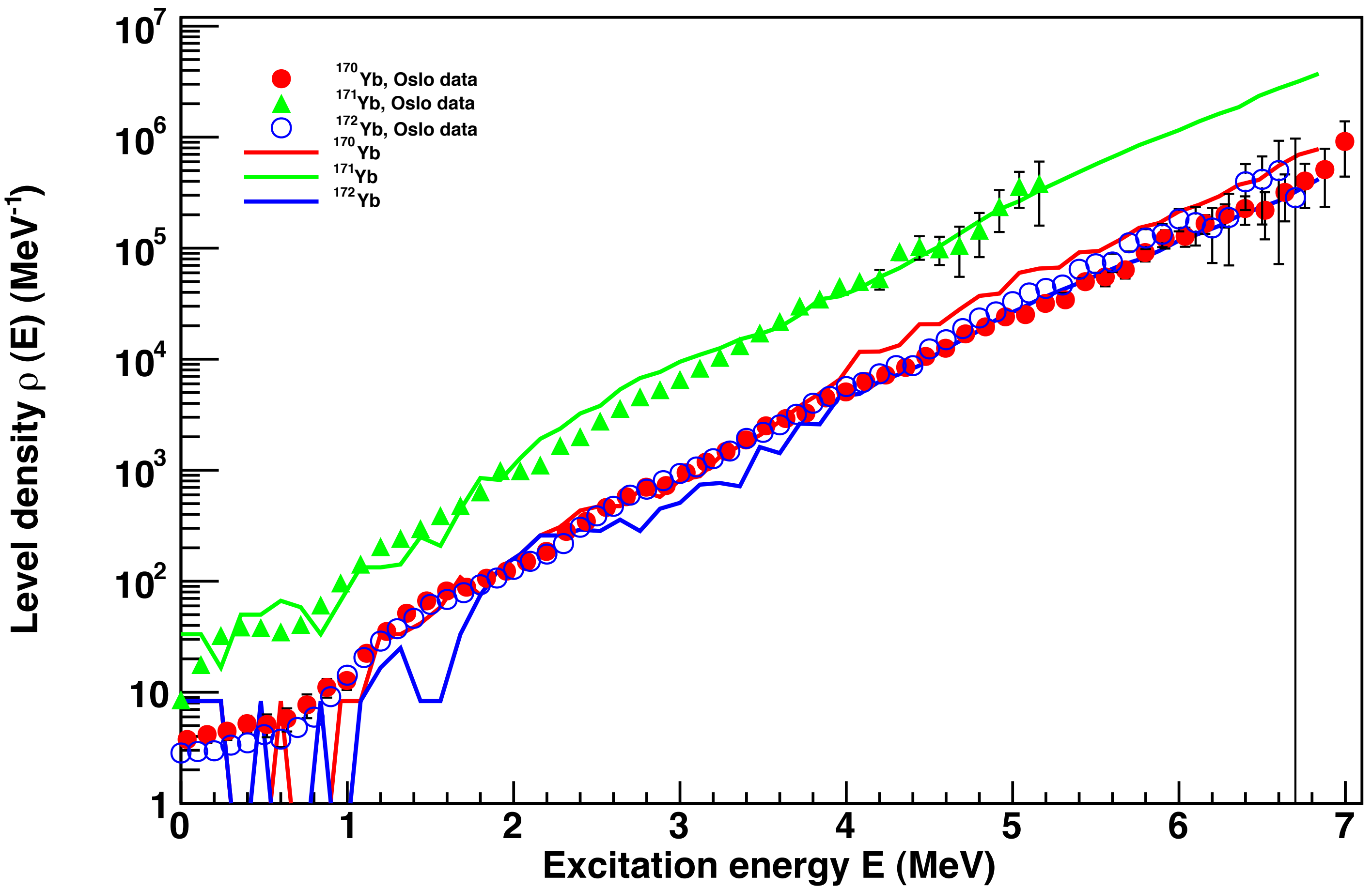
Entropy

Entropy S is as important as wave-function Ψ

Canonical ensemble (heat bath)	μ-canonical ensemble (isolated)
$S(T)$	$S(E)$
Sharp T, average E	Sharp E, fluctuating T
$Z(T) = \sum_{E=0}^{\infty} \Omega(E) e^{-E/kT}, \quad F(T) = -T \ln Z(T)$	
$S(T) = -\left(\frac{\partial F(T)}{\partial T}\right)$	$S(E) = k_B \ln \Omega(E)$
$\langle E(T) \rangle = F + TS$	$T(E) = \left(\frac{\partial S(E)}{\partial E}\right)^{-1}$
$C(T) = \left(\frac{\partial \langle E(T) \rangle}{\partial T}\right)$	$C(E) = \left(\frac{\partial T(E)}{\partial E}\right)^{-1}$

Multiplicity Ω is proportional to ρ

Scaling by quasi-particles



Spin distribution

Nuclear structure

State density ρ_{state}

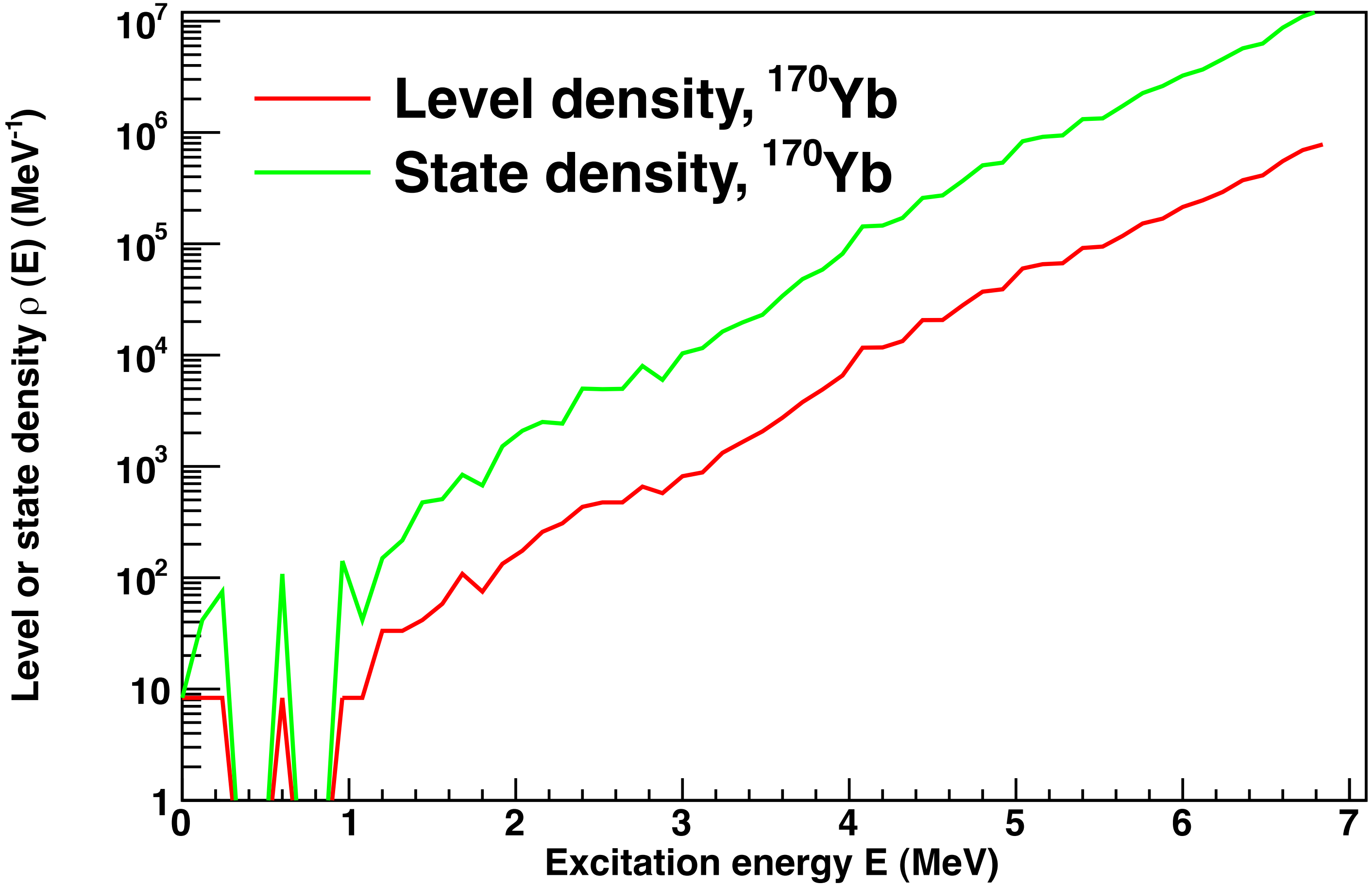
Reaction rates

Level density ρ_{level}

$$\rho_{state}(E) = (2\langle I(E)\rangle + 1) \cdot \rho_{level}(E)$$

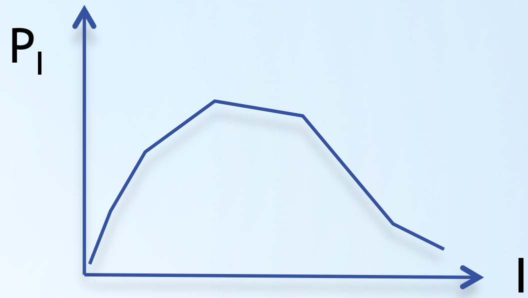
$$\langle I(E)\rangle = \Sigma P(I) \cdot I(E)$$

States and levels

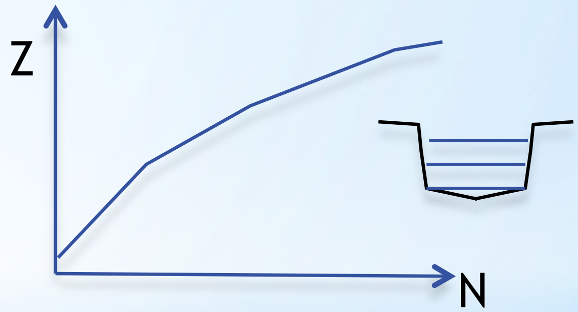


Discussion

- Spin/parity distributions in continuum



- Level density far away from β-stability



- Quasiparticles/collective motion