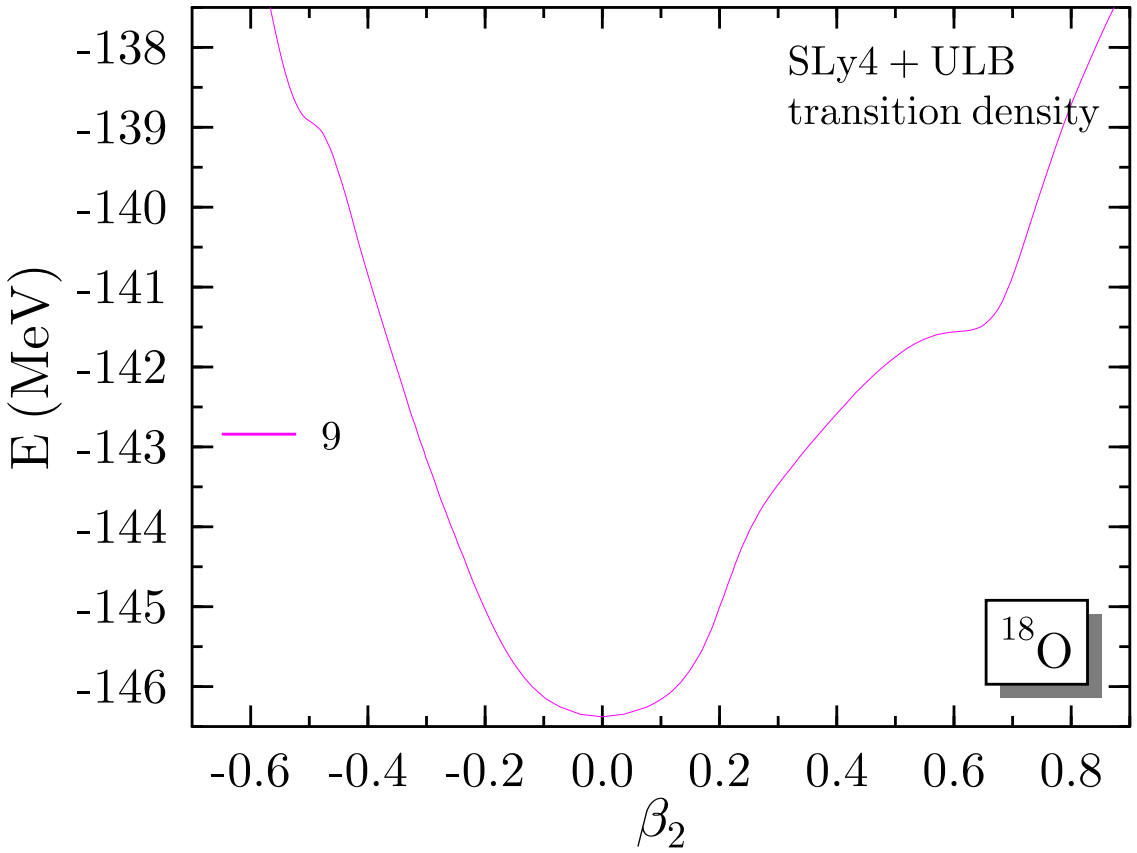
# Problem in PNP-HFB calculations




**PES**: $^{18}O$

**3D PNP-HFBLN (PAV)**

SLy4+ULB

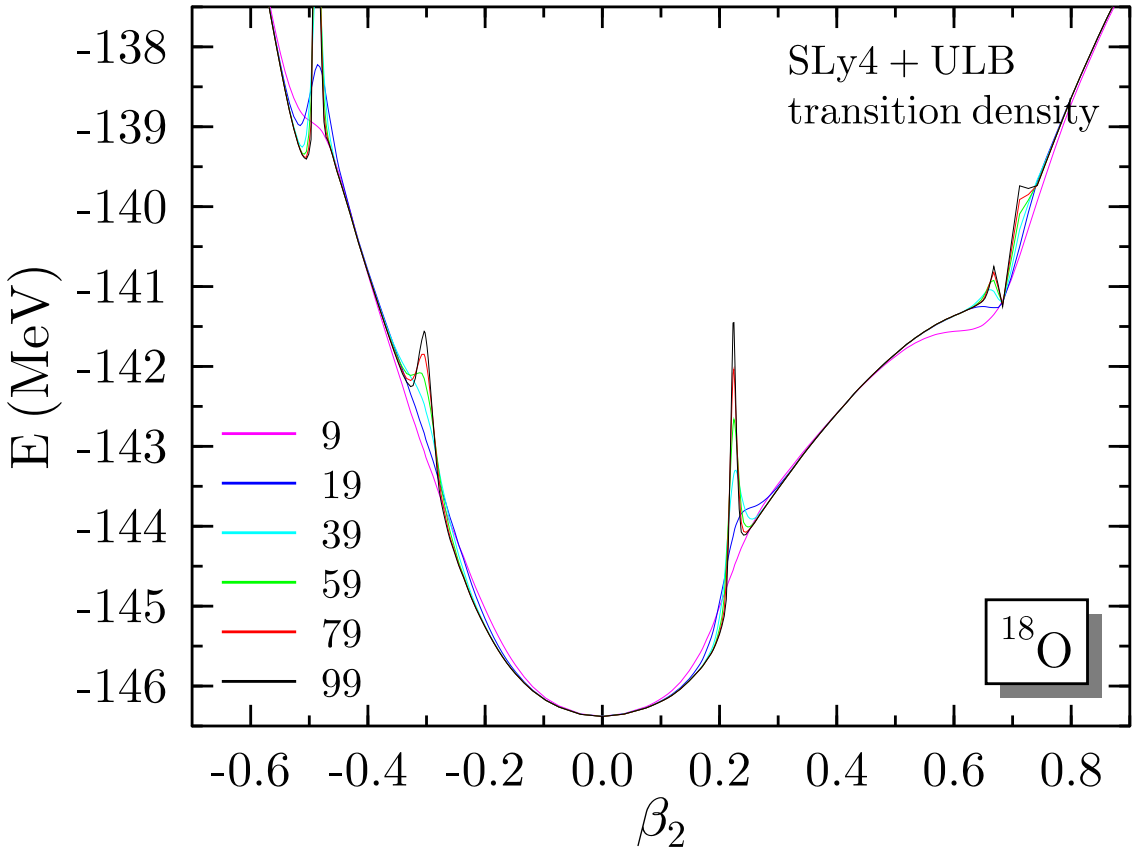
9 $\varphi$-integration points

✓Typical of calculations performed so far

✓Results look very reasonable and converged

✓But, shall we increase the number of integration point in gauge space ?

# Problem in PNP-HFB calculations




**PES**: $^{18}O$

**3D PNP-HFBLN (PAV)**

SLy4+ULB

9/99 $\varphi$-integration points

✓Divergence when two conjugated states $(\mu, \bar{\mu})$ cross $\lambda$, *Anguiano et al. (2001)*

✓Offset in the PES before and after the crossing, *Dobaczewski et al. priv. comm.*

✓Disappear in the Hamiltonian case $\bar{w}^{\rho\rho}_{\mu\nu\mu\nu} = \bar{w}^{\kappa\kappa}_{\mu\nu\mu\nu}$

✓More dramatic consequences for VAP calculations

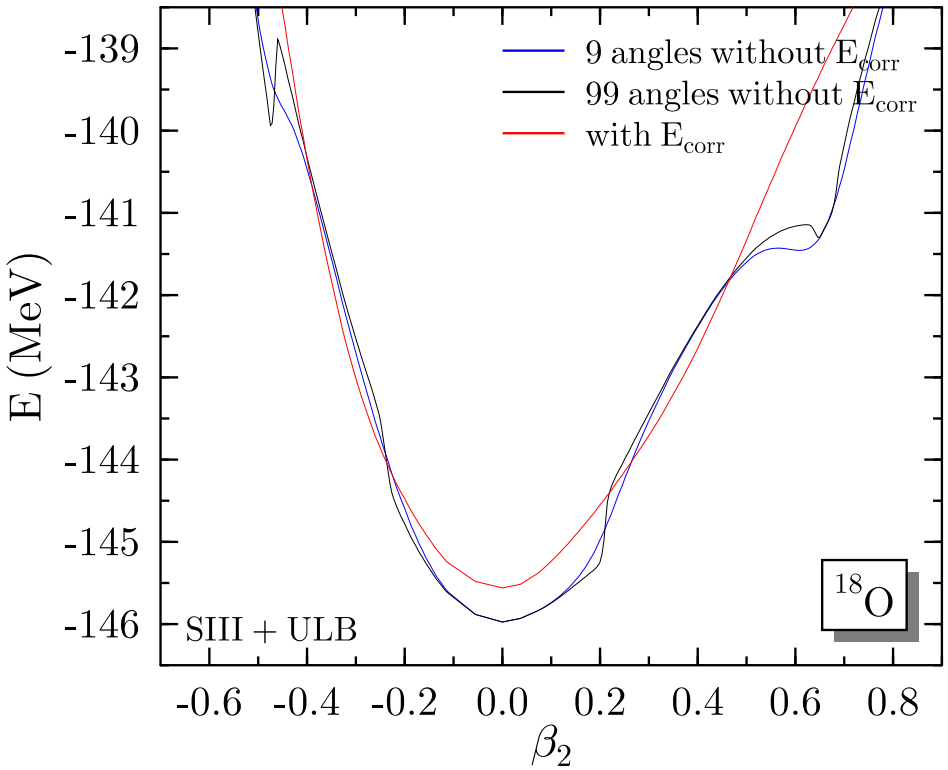
## Origin and solution to the problem M. Bender and T. D. ; preprint

✓Failure of the Generalized Wick Theorem (GWT) in the functional context $w^{\rho\rho}_{\mu\nu\mu\nu} \neq w^{\kappa\kappa}_{\mu\nu\mu\nu}$

$$\mathcal{E}^N_{SWT} = \mathcal{E}^N_{GWT} - \mathcal{E}^N_{spu.}$$

$$\mathcal{E}^N_{spu.} = \sum_{\mu>0} \left[ \left( w^{\rho\rho}_{\mu\mu\mu\mu} + w^{\rho\rho}_{\bar{\mu}\bar{\mu}\bar{\mu}\bar{\mu}} + w^{\rho\rho}_{\mu\bar{\mu}\mu\bar{\mu}} + w^{\rho\rho}_{\bar{\mu}\mu\bar{\mu}\mu} \right) - 4\, w^{\kappa\kappa}_{\mu\bar{\mu}\mu\bar{\mu}} \right] u^2_\mu v^4_\mu \int_0^{2\pi} d\varphi \, \frac{e^{-i\varphi N}}{2\pi\, \mathcal{D}_N} \, \frac{e^{2i\varphi}\left(e^{2i\varphi}-1\right)}{\left(u^2_\mu + v^2_\mu\, e^{2i\varphi}\right)^2} \prod_{\nu>0} (u^2_\nu + v^2_\nu\, e^{2i\varphi})$$

✓The correction does not change the SR functional at $\varphi = 0$




✓Better behaved when corrected

✓Absolute mass changes non-negligibly

✓Shoulder at $\beta = 0.7$ disappears

✓$0^+_2$ at 6.03 MeV in $^{16}O$ from proj-GCM?

✓Solution needed for GCM-type mixing

✓Solution for any type of projected-GCM calculation ; T. D. and D. Lacroix, preprint