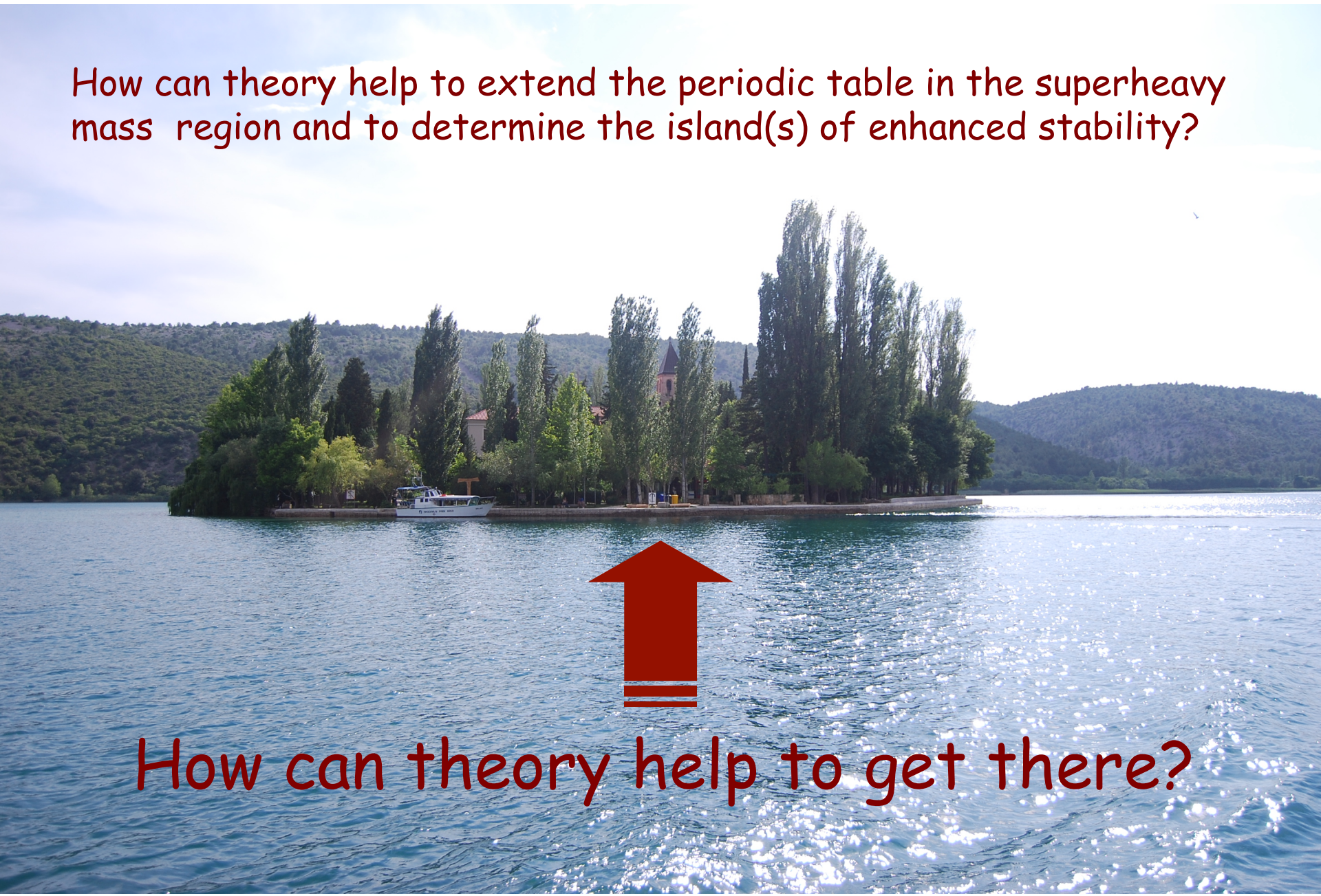
How can theory help to extend the periodic table in the superheavy mass region and to determine the island(s) of enhanced stability?



How can theory help to get there?

❖ Microscopic vs Macro-micro models: what can learn one from the other?

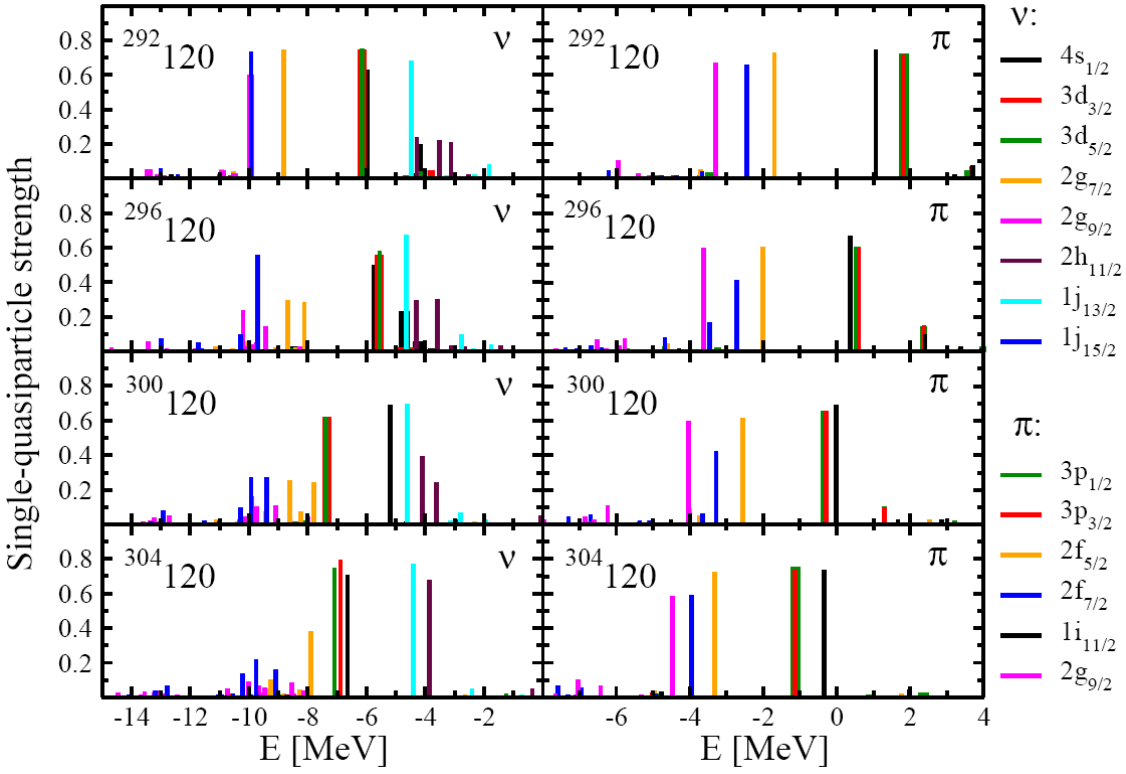
- How good are the existing mean-field (MF), or energy density functional (EDF), and Macro-micro (MM) approaches?
- Do we need to extend them and, if yes, how?
- Importance of self-consistency and universality in microscopic approaches.
- Role of many-body correlations beyond MF, readjustments of the EDF.
- How can we find "the best" underlying functional?
- Correlations in MM models?
- How can „ab initio" methods constrain EDF and beyond-EDF methods?
- Which experimental data can constrain EDF and beyond-MF methods? MM?

- Bridging cutting-edge structure and dynamics: Can we do this?
  - TDHF(B) models miss fluctuations: no mechanism for the, e.g., symmetry breaking!
  - Irregular interaction between macroscopic and intrinsic variables. How can microscopic models provide transport coefficients: friction, diffusion, etc.?
  - … ?
- Predictions to guide future experiments: can we do this?
  - Sensitivity of fission barriers to correlations - ?
  - Can microscopic models help to find the best projectile-target-energy combination to form compound nuclei?
  - … ?
- Links to other disciplines. Astrophysical relevance of SHE.

- Is there a first principles theory for the description SHN?
- Is there a Vision for the future of the field beyond the next 10 years?

Shell evolution in superheavy Z = 120 isotopes: Quasiparticle-vibration coupling (QVC) in a relativistic framework

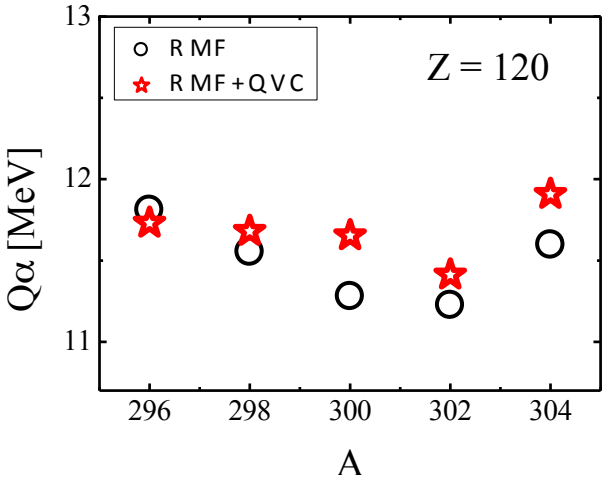
1. Relativistic Mean Field: spherical minima
2. π: collapse of pairing, clear shell gap
3. ν: regime of coexistance of pairing and the shell closure
4. Very soft nuclei: large amount of low-lying collective vibrational modes (~100 phonons below 15 MeV)



Vibrational corrections to binding energy

$$E_{VC} = -\sum_{\mu} \Omega_{\mu} \sum_{k_1 k_2} |Y^{\mu}_{k_1 k_2}|^2$$

Vibrational corrections to α-decay Q-values



Vibrational corrections:

1. Impact on the shell gaps
2. Smearing out the shell effects

Shell stabilization & vibration stabilization/destabilization (?)

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