MAX-PLANCK-INSTITUT
FÜR KERNPHYSIK

IsoQuant
SFB1225

Stringent Constraints on New Pseudoscalars

from Precision Hyperfine Splitting Measurements

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2506.03274

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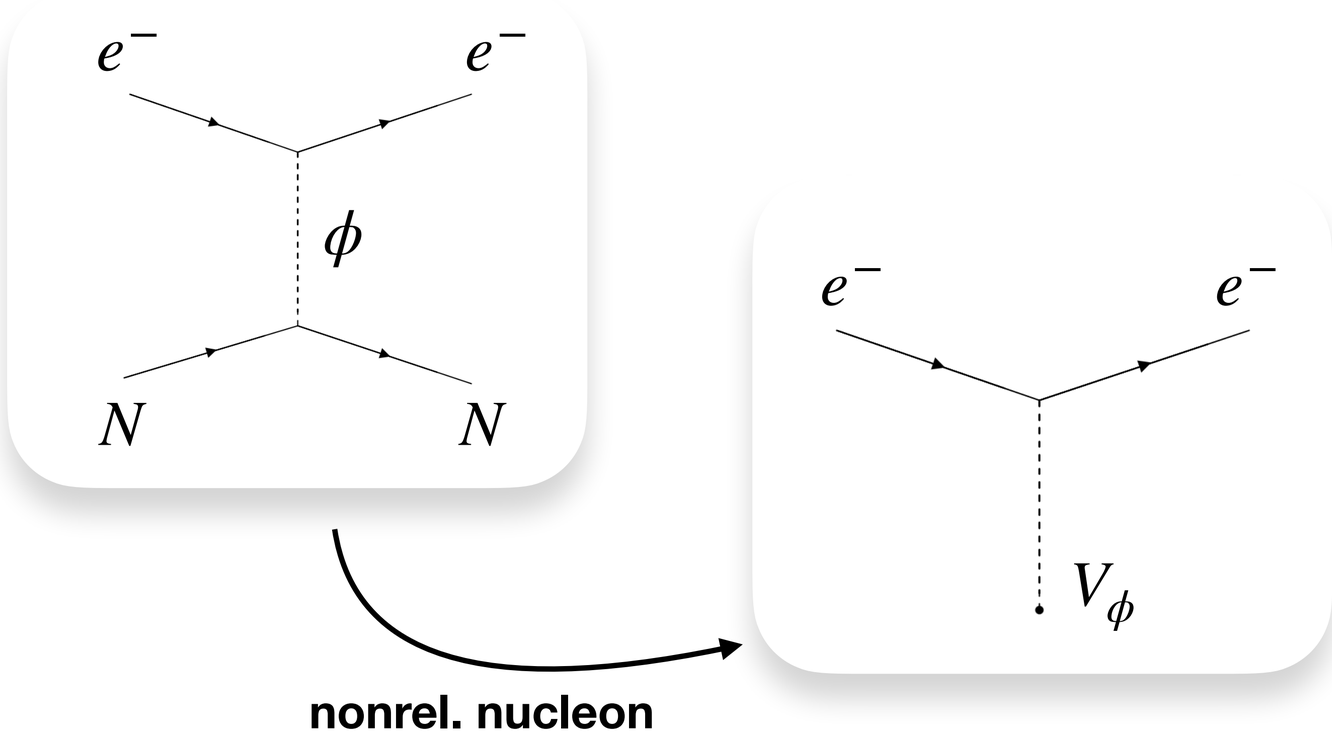
for Patras, September 23rd

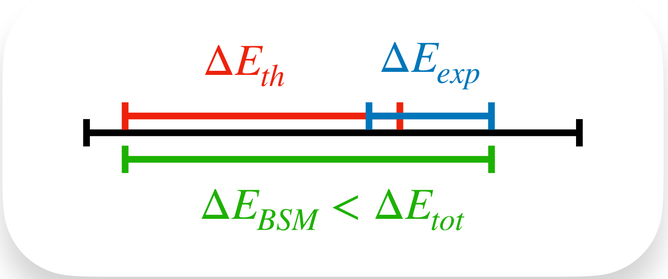
New Bosons & New Potentials

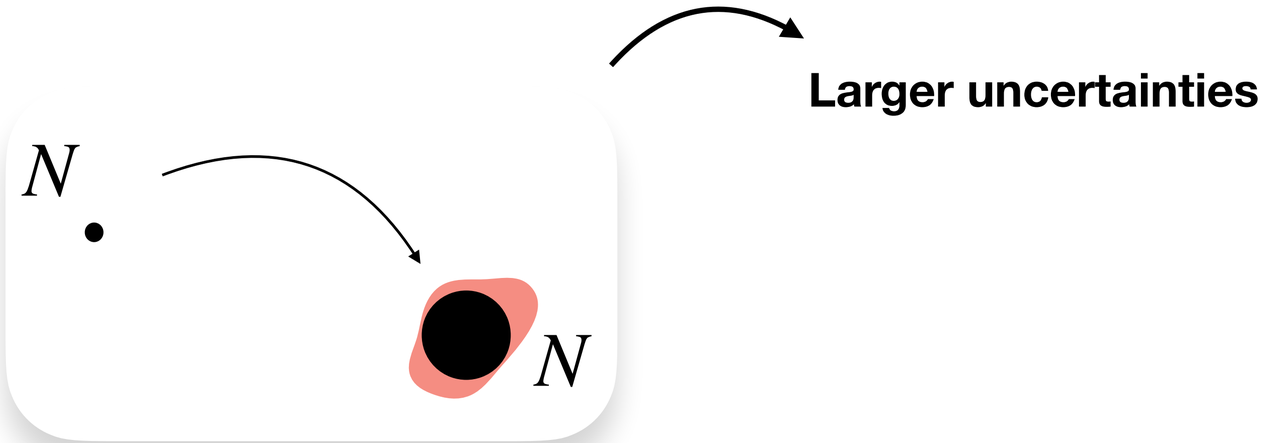
- Introducing new bosons also implies introducing new forces
  Moody & Wilczek
- Lead to energy shifts in atoms and ions Lei Cong et al (Review)
- Spin-dependent interactions give contributions to hyperfine structure



Hyperfine Splitting, Constraints & Issues

- We constrain new physics by comparing theory & experiment
- BSM effects stronger for heavier elements
- But nuclear size effects are an issue





Choosing a better Observable

Surpressing the Bohr Weisskopf effect

- Largest uncertainties from finite magnetization distribution (Bohr Weisskopf effect)
- Use specific differences to cancel this effect V. Shabaev et al
- Results in smaller theory errors

H-like

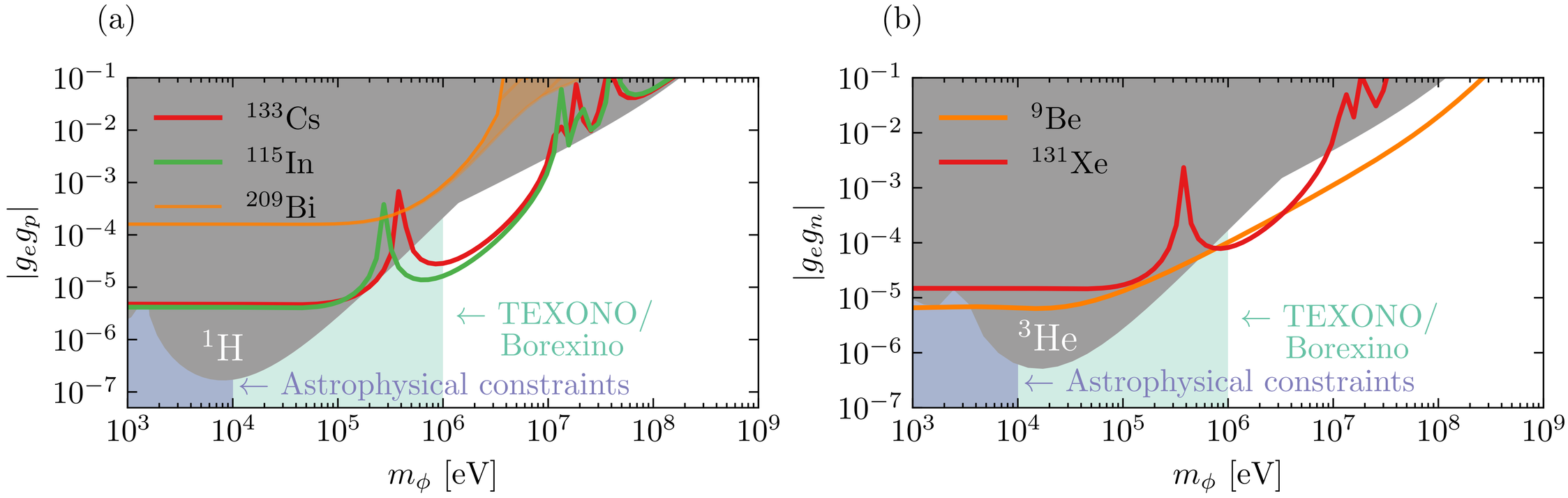
Same nuclear structure
→cancels in the ratio

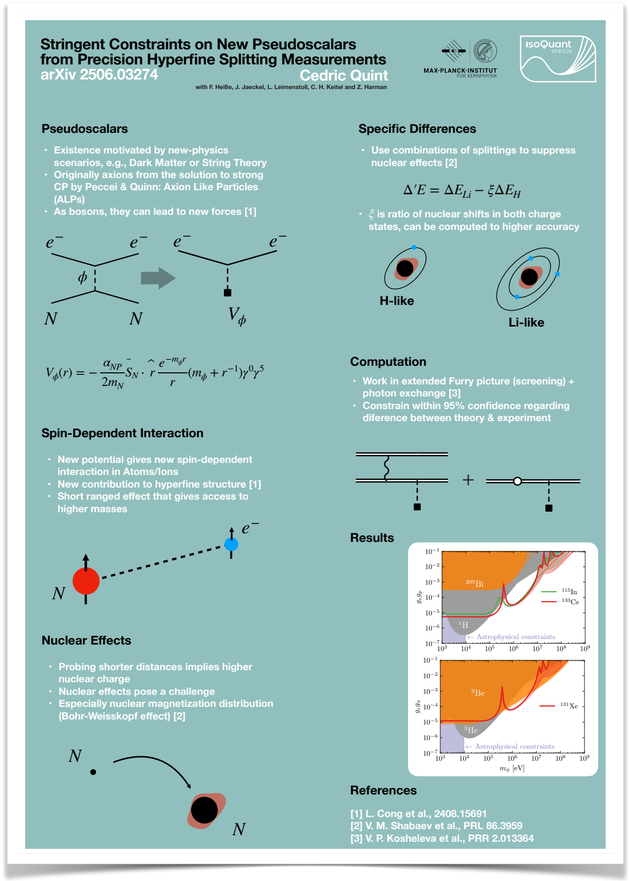
Li-like

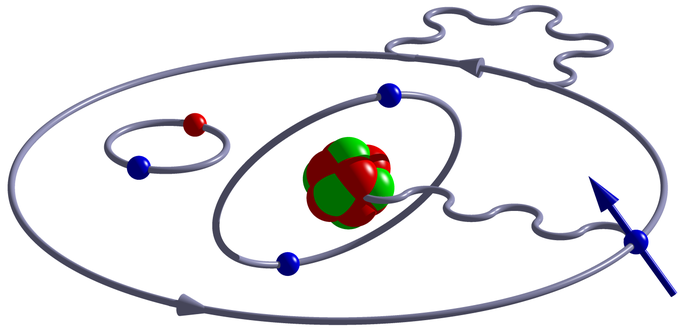
$$\Delta' E = \Delta E_{Li} - \xi \cdot \Delta E_H \; ; \qquad \xi = \frac{\Delta E_{Li}^{BW}}{\Delta E_H^{BW}}$$

Results

Experimental Constraints & Projections







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Thank you for listening!

Feel free to come to my poster!