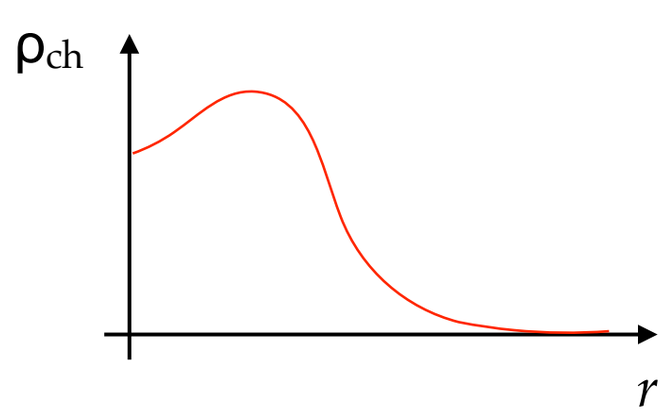
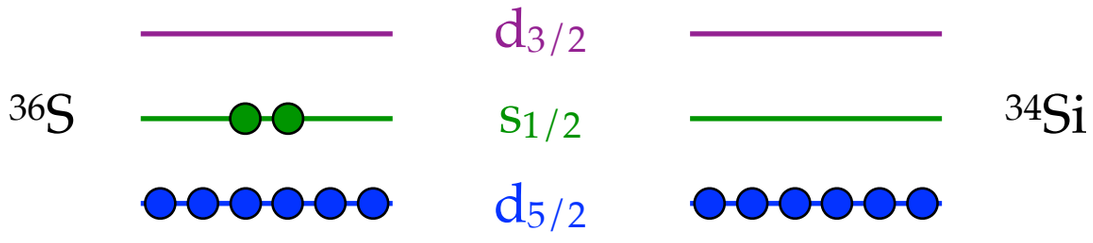
The case of ^{34}Si

- **Unconventional depletion** ("bubble") in the centre of ρ_{ch} conjectured for certain nuclei
- **Purely quantum mechanical effect**
  - $\ell = 0$ orbitals display radial distribution peaked at $r = 0$
  - $\ell \neq 0$ orbitals are instead suppressed at small r
  - Vacancy of s states ($\ell = 0$) embedded in larger-ℓ orbitals might cause central depletion
- **Conjectured associated effect on spin-orbit splitting**
  - Non-zero derivative at the interior
  - Spin-orbit potential of "non-natural" sign
  - Reduction of (energy) splitting of low-ℓ spin-orbit partners



- Bubbles predicted for hyper-heavy nuclei [Dechargé *et al.* 2003]
- In light/medium-mass nuclei the **most promising candidate is ^{34}Si**

[Todd-Rutel *et al.* 2004, Khan *et al.* 2008, …]



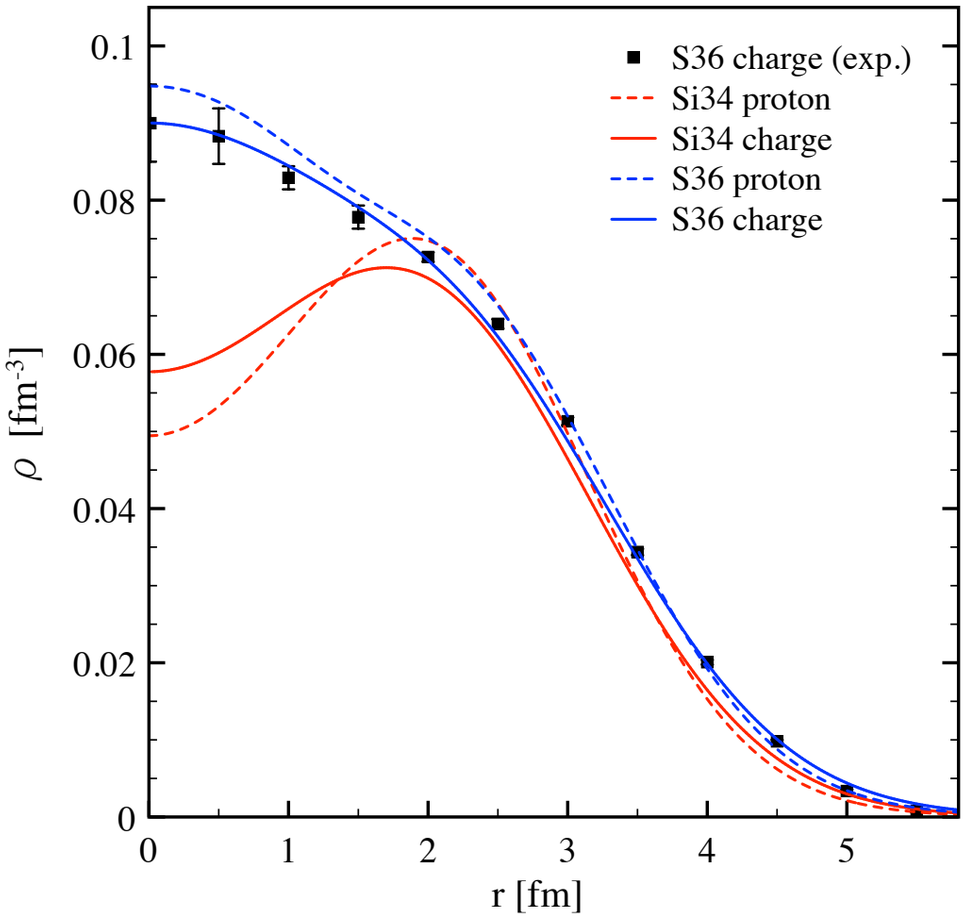
The case of ^{34}Si

- **Ab initio calculations predict the presence of a charge bubble**
  - Good reproduction of g.s. properties

E [MeV]	ADC(1)	ADC(2)	ADC(3)	Experiment
^{34}Si	-84.481	-274.626	-282.938	-283.427
^{36}S	-90.007	-296.060	-305.767	-308.714

$\langle r^2_{\rm ch}\rangle^{1/2}$	ADC(1)	ADC(2)	ADC(3)	Experiment
^{34}Si	3.270	3.189	3.187	-
^{36}S	3.395	3.291	3.285	3.2985 $\pm$ 0.0024

  - **Mild central depletion predicted**



➪ Charge density computed via folding with the finite charge of the proton

➪ Folding smears out central depletion

➪ Excellent agreement with experimental charge distribution of ^{36}S

[Duguet *et al.* 2017]