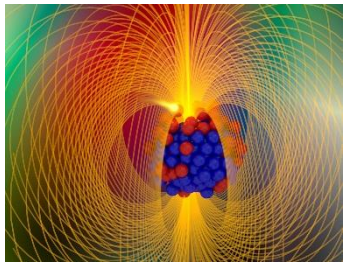
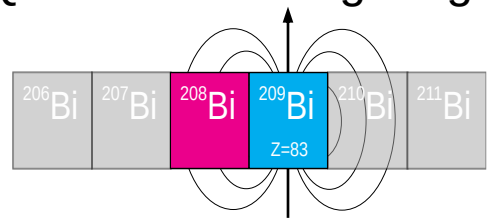
E128 – Laser Spectroscopy of Hydrogenlike and Lithiumlike Bismuth
Motivation

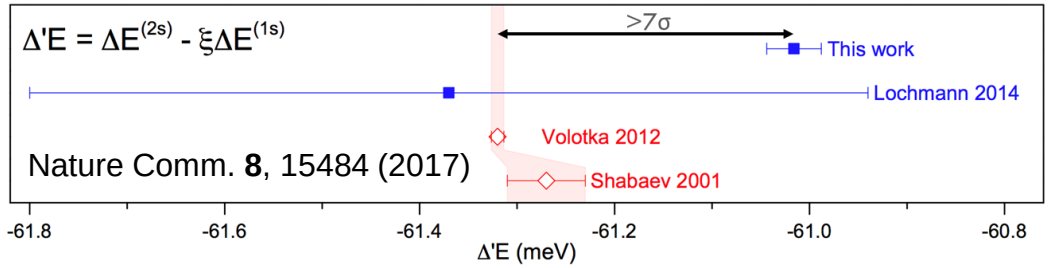


HFS Splitting in $^{209}Bi^{80+,82+}$

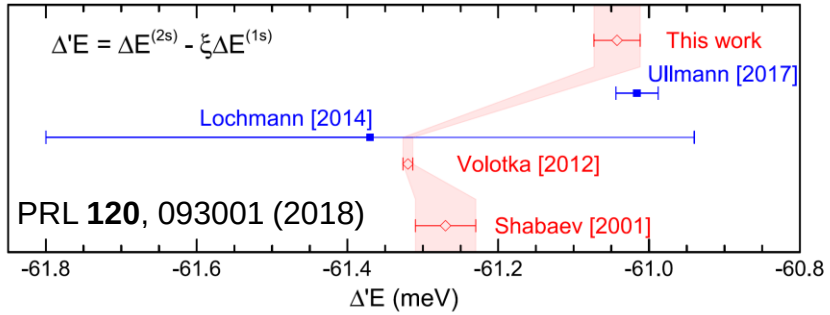
→ Test of QED in the strong magnetic fields



Hyperfine Puzzle of strong-field bound-state QED



Redetermination of $\mu(^{209}Bi)$ by NMR:



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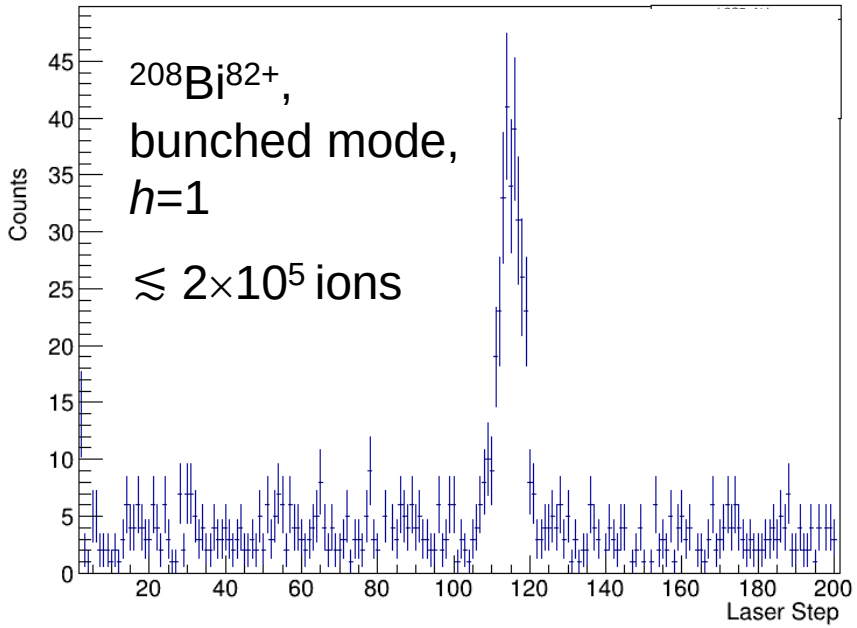
E128 - Dielectronic Recombination-assisted laser spectroscopy: A new tool to investigate the hyperfine-puzzle in $Bi^{80+;82+}$

Status:

- laser spectroscopy on $^{208}Bi^{82+}$ with $\approx 10^5$ ions
- new optical detection region for vacuum-UV
- production of $^{208}Bi^{82+}$ in thick target, injection, cooling, and scraping
- background reduction by hardware or software gating after laser shot
- improved timing procedures with particle detectors
- $h = 1$ operation for signal improvement

Transition of H-like ^{208}Bi found. QED test via specific difference requires the determination in Li-like ions:

direct fluorescence detection not possible
„red photons“ + long lifetime
⇒ inefficient detection with high background
Instead: Laser Excitation + DR (particle detection)
New technique, demonstration with stable $^{209}Bi^{80+}$ required



1 d: beam preparation in ESR
2 d: locate resonance of $^{209}Bi^{80+}$
2 d: re-establish DR @ ESR
3 d: search and optimize DRALS signal
1 d: production test og $^{208}Bi^{80+}$

Σ = 9 d = 27 shifts

Critical issues:

- electron cooler drift tubes must be repaired
- require MeVVA source and high SIS intensities >10^9 ions

Experimental Setup: