Towards parity non conservation measurements in francium

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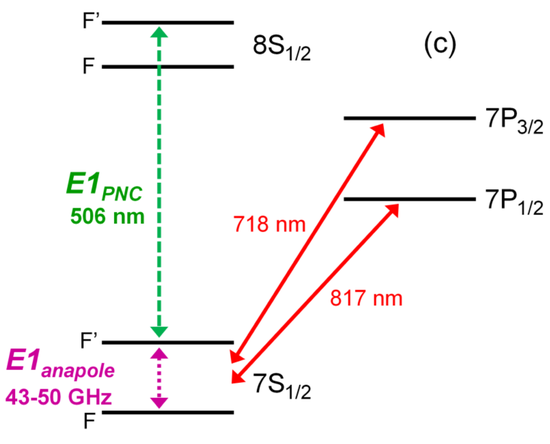
Francium for APNC:

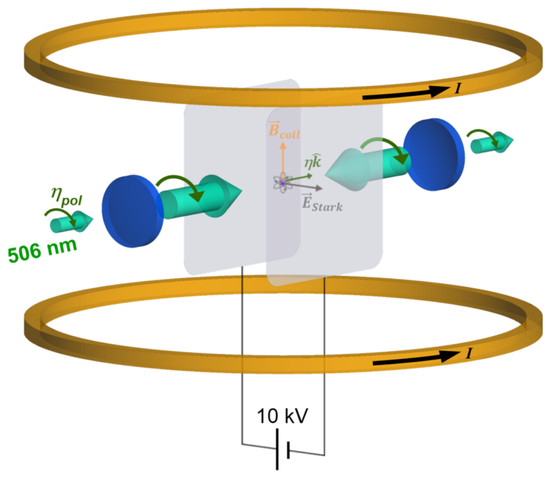
Francium is an attractive candidate for APNC studies.
Good
- Single valance electron.
- APNC effects 18 times larger.
- Atomic theory same level as Cs.

Not so good
- Radioactive.



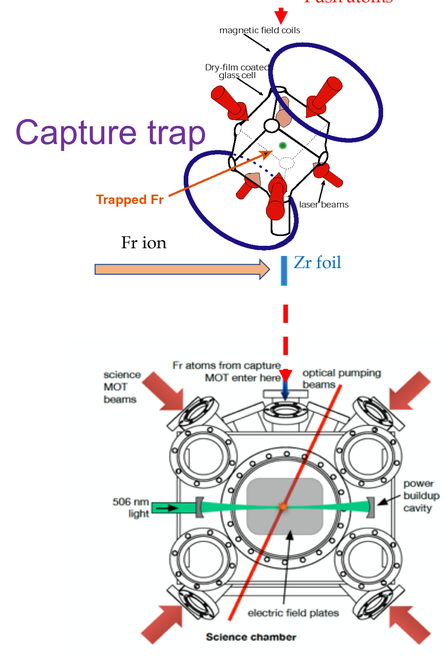
Measurement scheme:

- Define a co ordinate using electric field, magnetic field and laser propagation direction.
- Use interference of electric field induced signal and APNC induced signal.
- Compare transition rate under coordinate reversal.



Preparation:

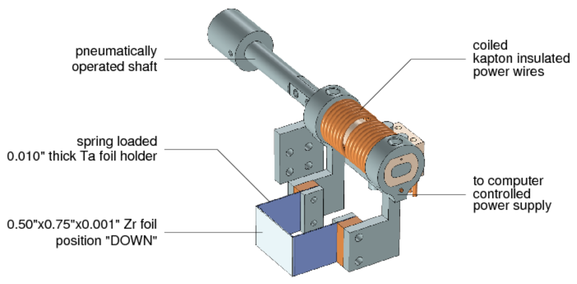
- Online collection from ion beam at ISAC, up to 10^9 /s, UC_x target, 500 MeV proton.
- Up to 50% transfer.



Science chamber

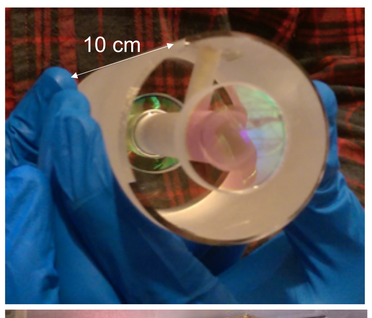
Neutralizer:

- Zr foil.
- 800°C, up to 30% release.
- 500,000 cycles.



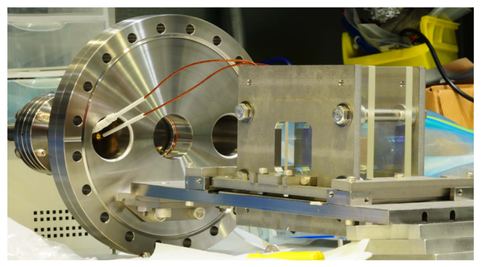
506 nm Laser lock:

- Temperature stabilized ULE cavity reference.
- Fiber EOM shifter.
- PDH method.



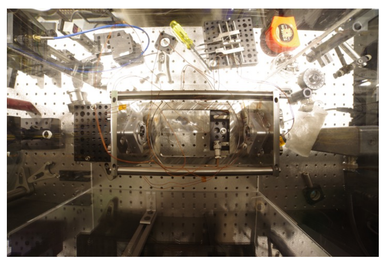
Transparent electrodes:

- Up to 15 kV at mid 10^{-10} Torr.
- UHV conductive epoxy.
- Al spacer.



Power buildup cavity:

- Factor of 3000 power build up.
- Titanium frame.
- UHV mirror mount.
- Piezo in Titanium casing.
- Needs to work at mid 10^{-10} Torr.
- Currently testing outside vacuum.

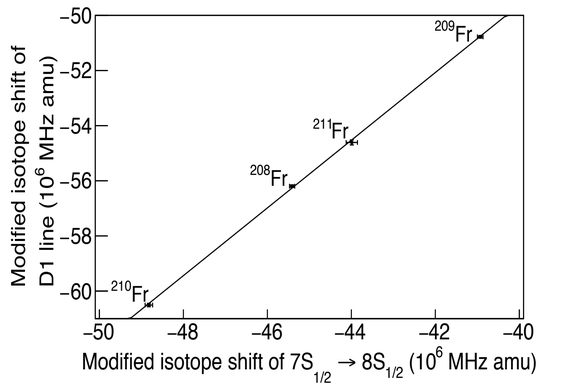


Tests with Rubidium:

Stark induced 5s➛6s in ^{87}Rb

Stark shift 5s➛6s in ^{87}Rb (two photon)

Conclusion:



Modified King plot of the 7s➛8s and D1 line

- Measured ratio of Field shifts
  1.228 ± 0.019 (Experiment)
  1.234 ± 0.010 (Theory)
- System ready for first observation of Stark induced 7s→8s transition.
- Aiming for measurements of 7s→8s Stark induced transition polarizabilities and M1 transition amplitude in September 2018.

References:

- M Kalita et al. Phys Rev A 97,042507 (2018).
- Zhang et al. Phys Rev Lett 115,042501 (2015).
- Collister et al., Phys Rev A 90, 052502 (2014) and A 92, 019902(E) (2015).

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