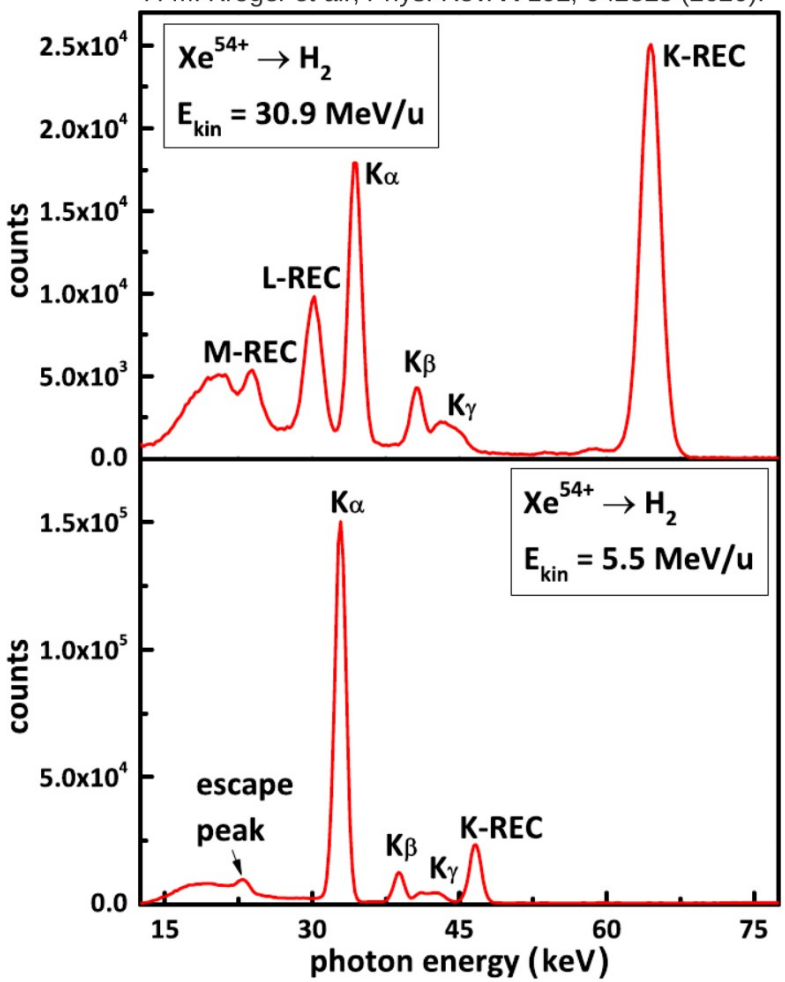
Proposal for HITRAP: **Charge exchange at low collision energies**

ESR electron capture measurement

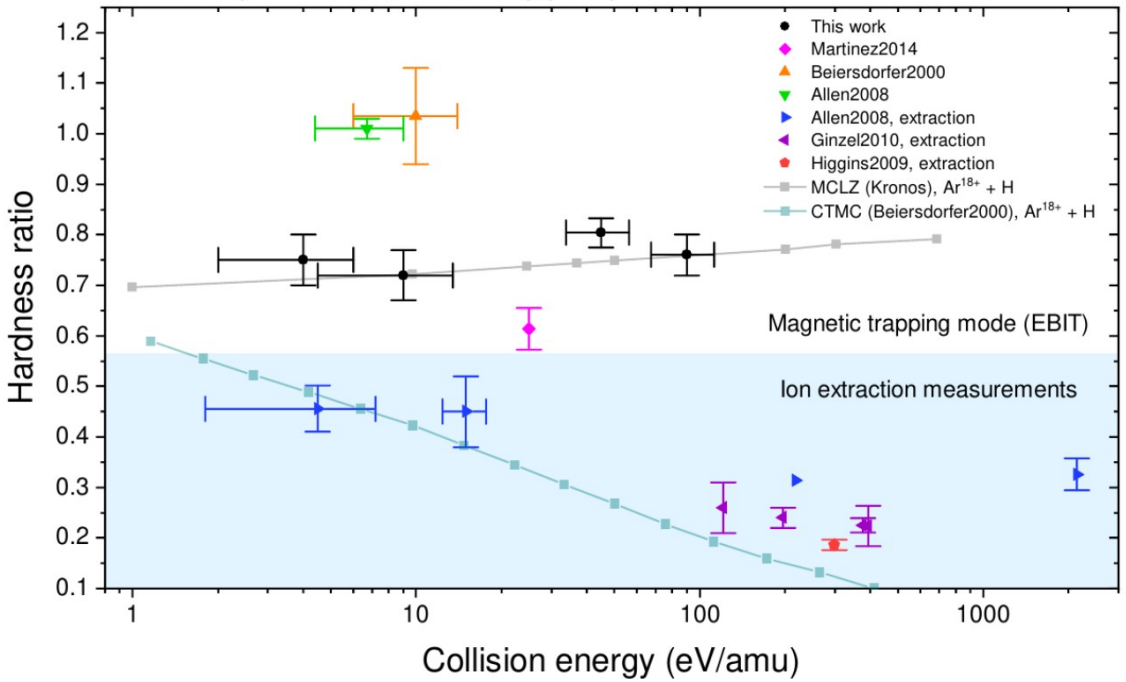
$Xe^{54+} + H_2$

F. M. Kröger *et al.*, Phys. Rev. **A** 102, 042825 (2020).



Low collision energies

S. Dobrodey, PhD thesis, Heidelberg (2019).



Proposal: Record x-ray spectra of charge exchange between Xe^{54+} and H_2 at HITRAP gas target with keV/u collision energies

- provide heavy ion data at low energies
- benchmark codes relevant for astrophysics
- complement measurements at higher energies

(See also other proposals by P.-M. Hillenbrand and N. Petridis.)

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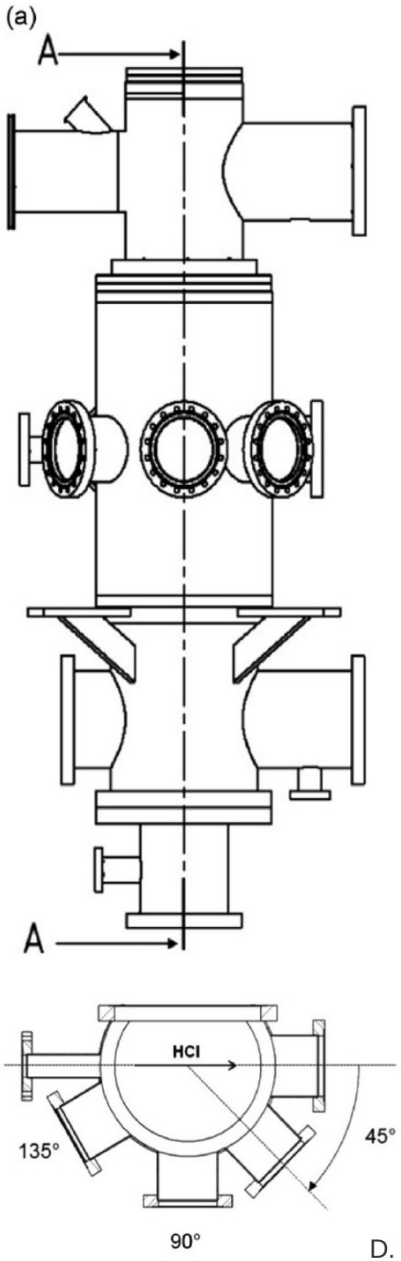


- pulsed supersonic gas jet target for HITRAP exists
- currently in Frankfurt
- column density: 10^{11} 1/cm^2

10^5 Xe^{54+} ions per cycle (5 keV/q), one cycle every 40 seconds

- approx. 100 CX events per cycle
- on average approx. **1 photon per cycle** on a single 70mm HPGe detector
- 120 hours (5 full days) per detector for <10% accuracy in K_β/K_α

ideal!

Proposal:

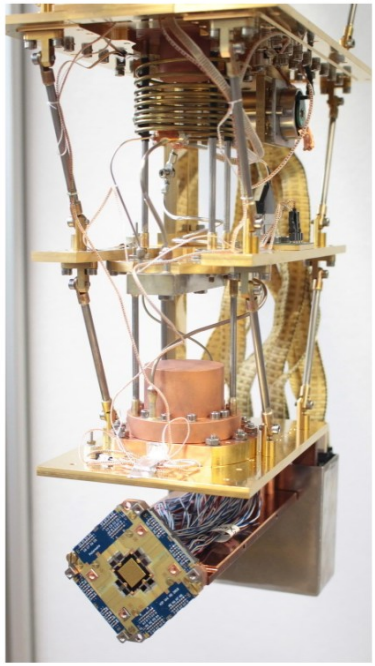
- 3 different collison energies, using a pulsed drift tube
- 3 (or more) detectors (1 count per cycle)

→ **120 hours (5 days) total measurement time**

- correction for double electron capture by simultaneous recording of time-of-flight of products
- variability of DEC/SEC ratio due to Poisson noise: approx. 30%

Alternative: *maXs microcalorimeter detector*

- multi-hit capability
- potentially resolves Xe^{52+} from Xe^{53+}



D. Tiedemann *et al.*, NIM A **764**, 387-393 (2014).

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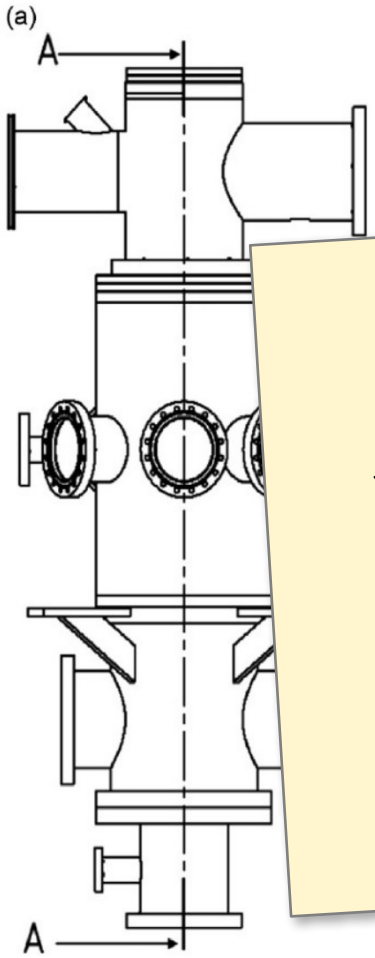

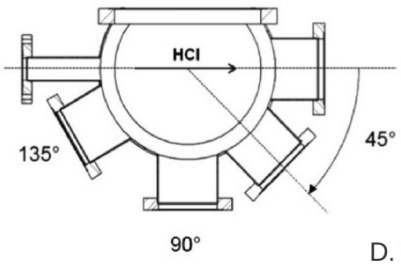

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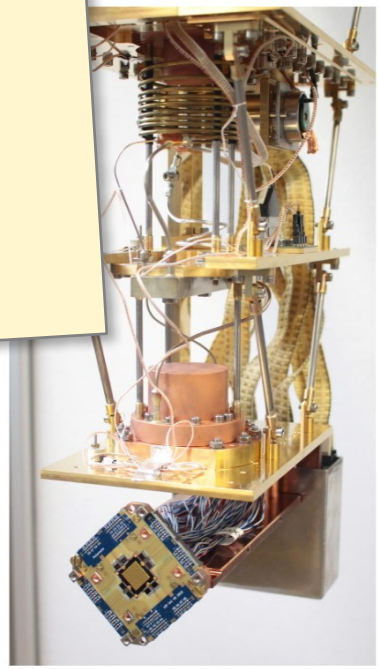
9 shifts initial setup
15 shifts measurements
3 shifts energy switching

27 shifts total

ideal!

... ratio due to Poisson noise:
approx. 30%



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