The case for ^{26}Si beams at ISAC

A walk through the experimental hall…

Possible Experiments and EEC proposals
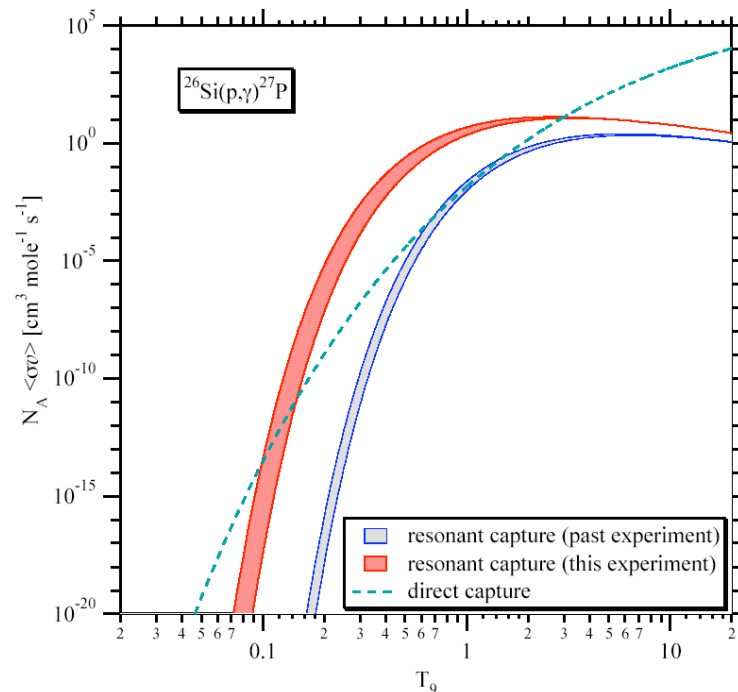
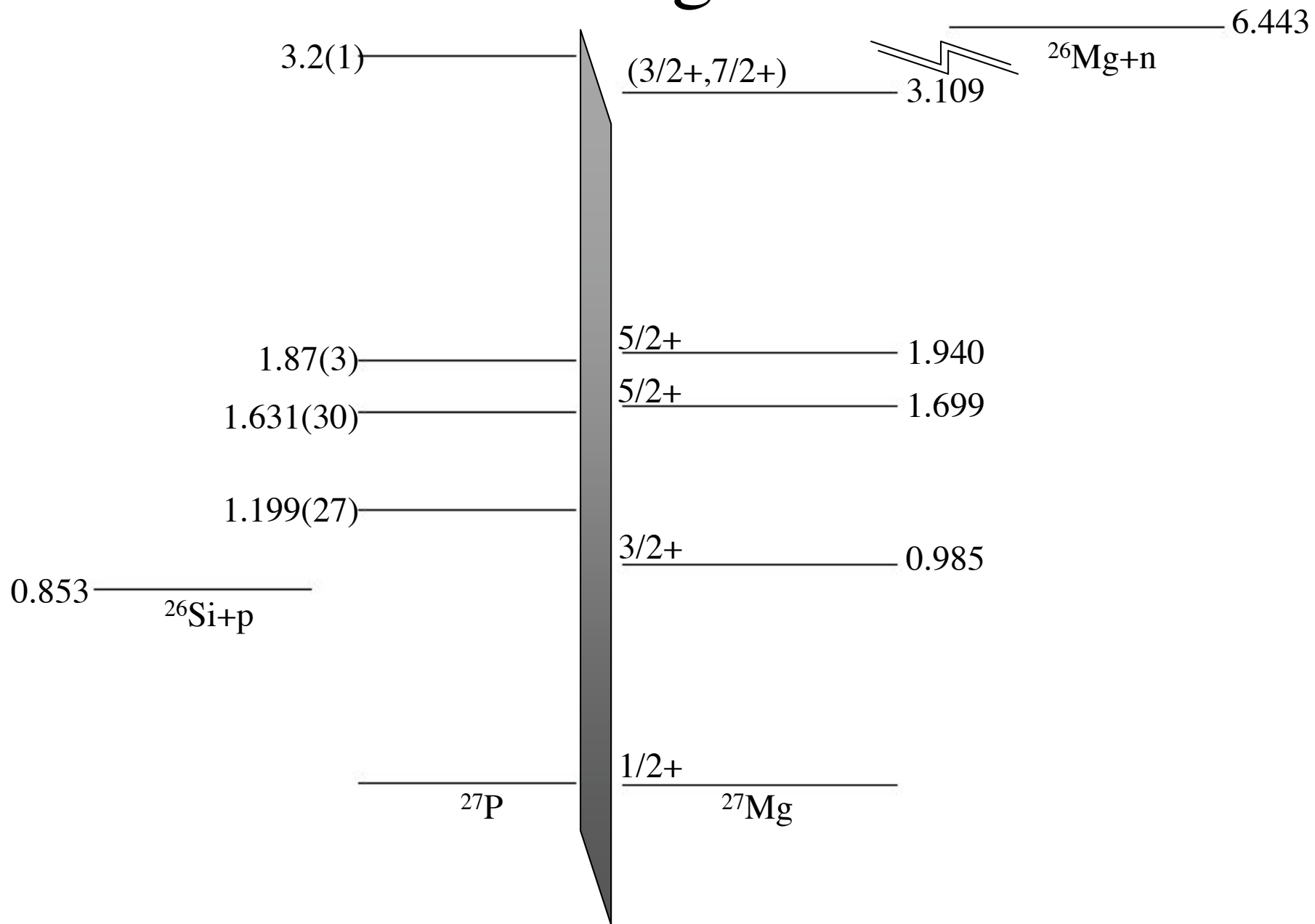| Experiment	Device	Measurement	Motivation	Required Beam Intensity
^{26}Si(p,γ)	DRAGON	$\omega\gamma$, E_r	astrophysics	$\sim 10^7$
^{26}Si(p,γ)	DRAGON w/Ge	E_x, $\Delta m(^{27}P)$	masses	$\sim 10^{7\text{-}8}$
^{26}Si(p,p)	TUDA	Γ_p,E_r,E_x	structure	$\sim 10^6$
^{26}Si(β^+)	tape, scint., NaI	$T_{1/2}$	half-life [2.234(13) sec.]	$\sim 10^3$
^{26}Si(β^+)	TITAN	$Q(\beta^+)$,$\Delta m(^{26}Si)$, $\Delta m(^{26m}Al)$	masses	$\sim 10^2$

Motivation: ^{26}Si(p,γ)

- Rate affects population of ^{26m}Al, which in turn could affect ^{26}Al abundance…
- Using DRAGON, measure resonance strength

^{26}Si(p,γ)^{27}P: Status

- One measurement of 1st excited state in ^{27}P

- This one (p,γ) resonance, ωγ~5 meV, E_r=346(27), determines rate (below)

- Mass of ^{26}Si known to 3 keV, mass of ^{27}P known to 27 keV (through two measurements, which differ by ~ 80 keV)

- Proton strength dominates higher lying states => no DRAGON measurement, but possible TUDA measurement for states $\Gamma_p \geq 1$keV?
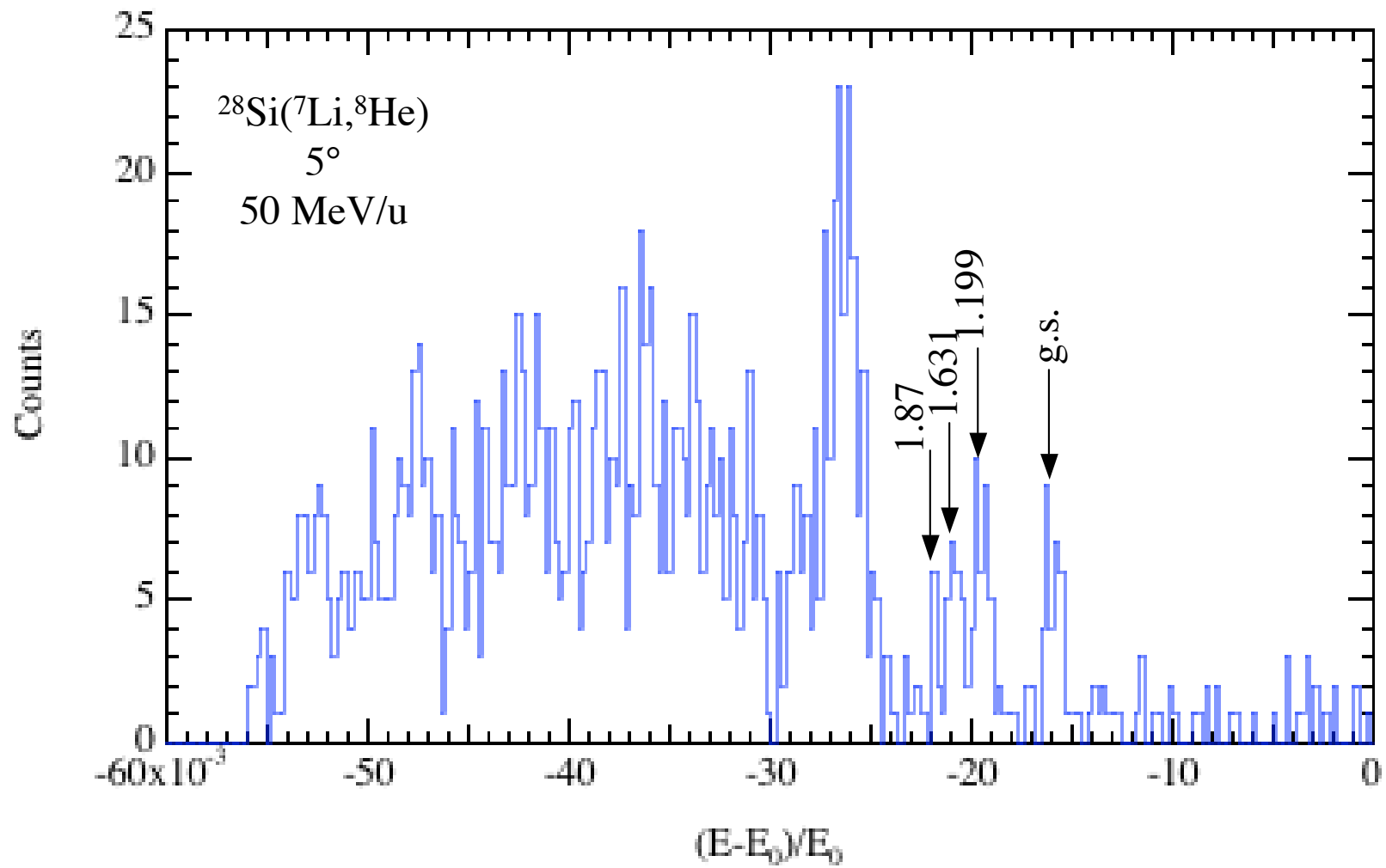
^{27}P - ^{27}Mg levels

6.443

^{26}Mg+n

3.2(1)

(3/2+,7/2+) ——— 3.109

5/2+ ——— 1.940

1.87(3)

5/2+ ——— 1.699

1.631(30)

1.199(27)

3/2+ ——— 0.985

0.853

^{26}Si+p

1/2+

^{27}P ^{27}Mg

E_x[MeV]	E_r[MeV]	J^π	Γ_γ[meV]	Γ_p[meV]	$\omega\gamma$[meV]
1.199	0.34(3)	3/2+	3.4	3.5	3.5
1.631	0.77(3)	5/2+	0.33	7500	1

^{26}Si(p,γ): Experimental Goals

- $\omega\gamma$ measurement ~10%
  - 5 meV, 10^7, ~30 counts/day
- E_r ~ 1 keV
- E_x , ^{27}P mass measurement (1keV vs 27 keV)
  - With BGO?
  - With two big, fat, C.S.? Ge

Si beams?…

- Probably use TiC target
- Feed in F_2 gas, and extract SiF_x
- Ionization potential too high for surface ion source => FEBIAD ion source
- Laser ionization???
- Difficulties?
  - $\Delta m(^{26}Si(-7.145),\ ^{26}Na(-6.902))=1/100,000$ => separation at HRMS not possible
  - ^{26}Si beta decay is gamma-less.

Possible Experiments II

- ^{26}Si mass measurement with TITAN
- ^{26}Si(β^+) Q-value measurement with TITAN
- ^{26}Si(β^+) half-life measurement with tape/scint/NaI(for veto) system