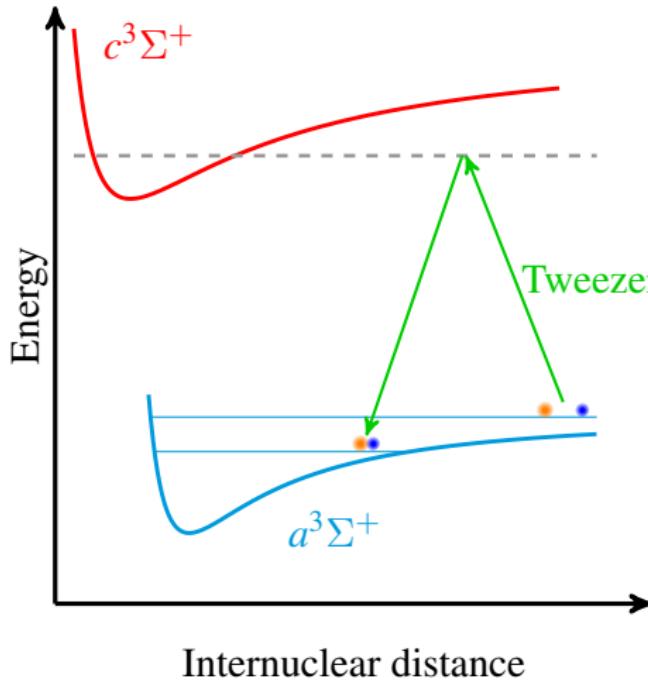


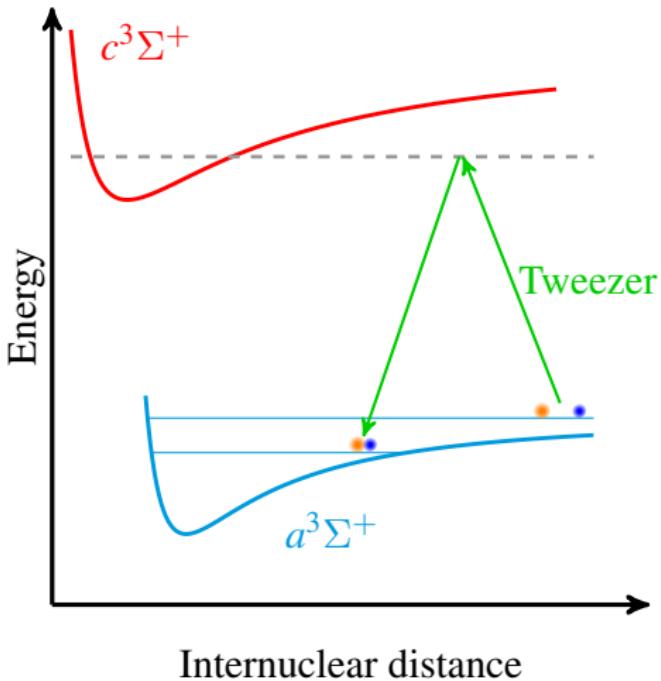
NaCs lab update

Yichao Yu

Ni Group

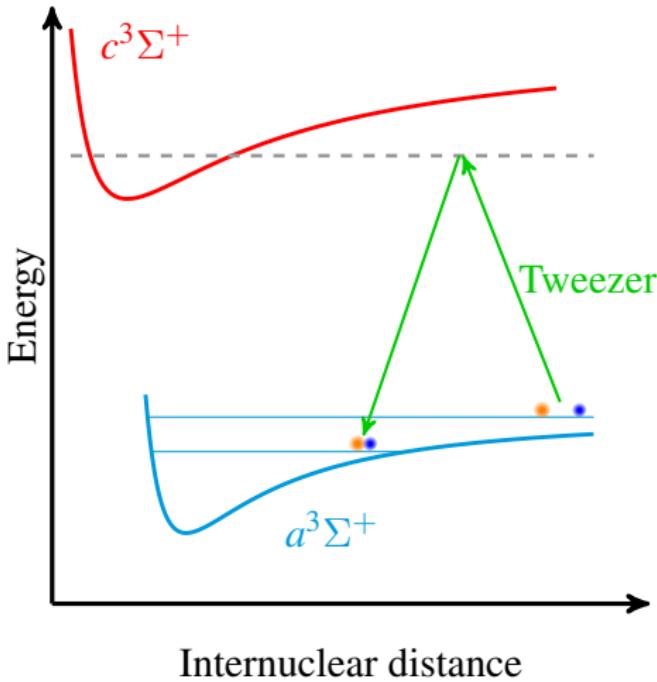
Feb. 21, 2020





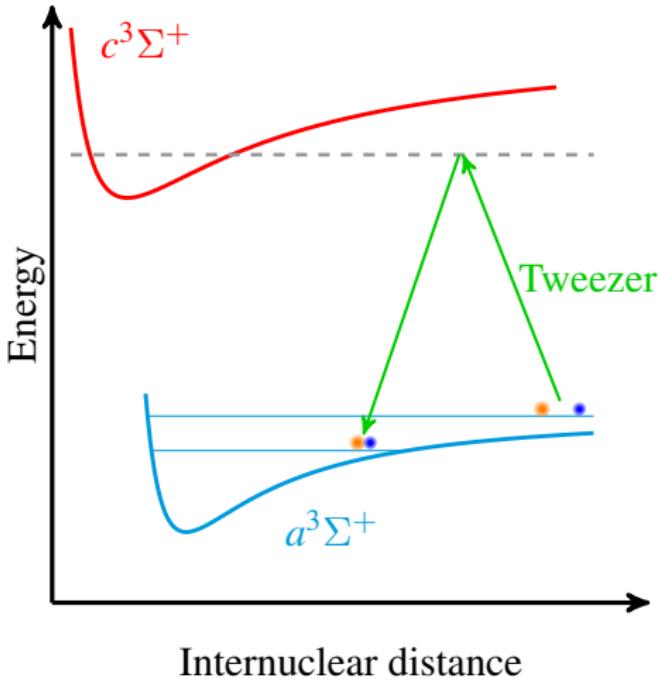
No Rabi oscillation





Still
No Rabi oscillation



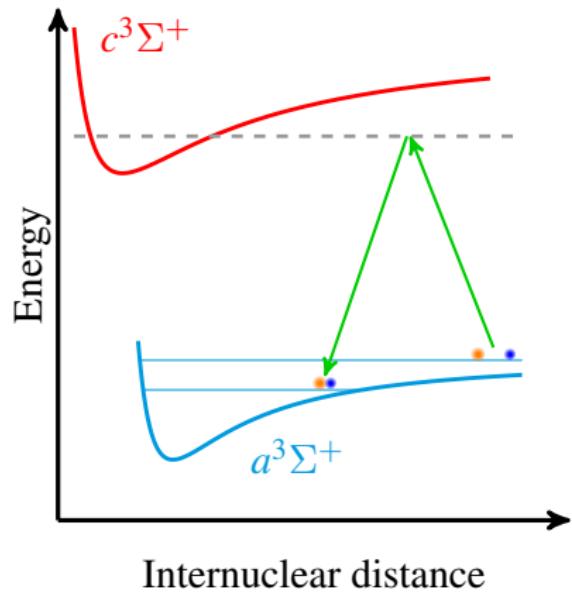


Still
No Rabi oscillation



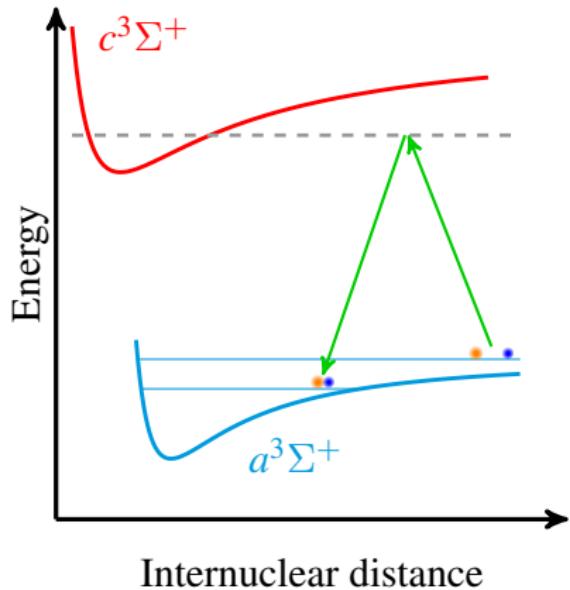
- Understand the issue
- Find a better approach

What can go wrong?



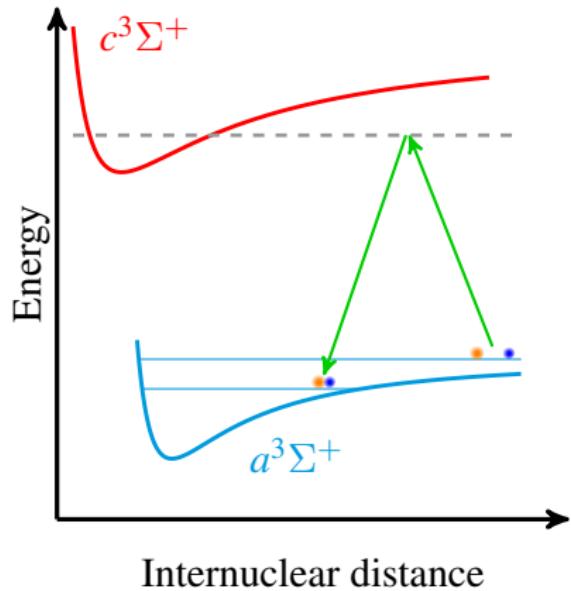
What can go wrong?

Condition	Rabi Oscillation
b	No
r	No
K	No
No	No
...	Still No
...	...



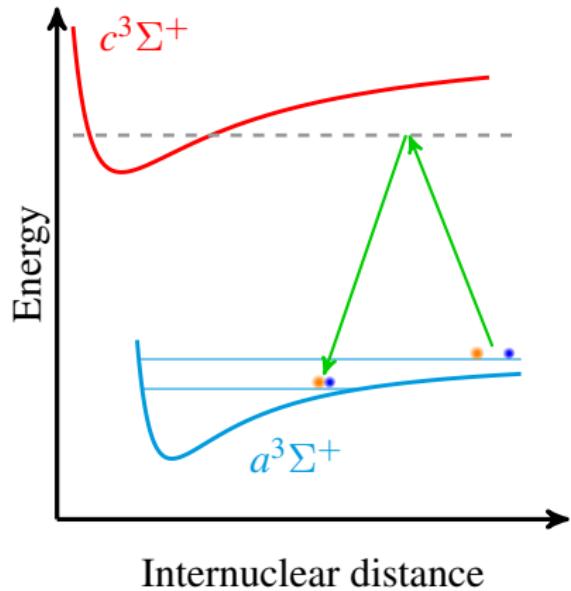
What can go wrong?

$$\frac{\Gamma_{\text{(Line width)}}}{\Omega_{\text{(Rabi frequency)}}}$$



What can go wrong?

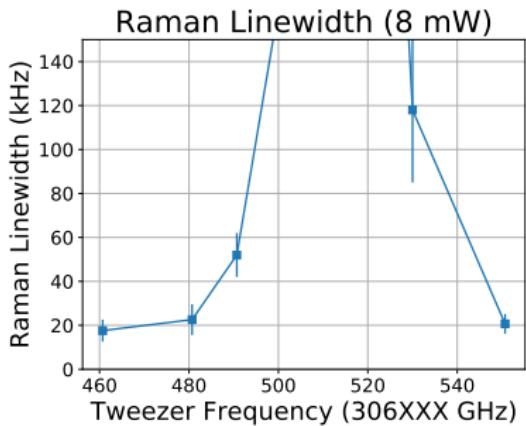
$$\frac{\Gamma_{\text{(Line width)}}}{\Omega_{\text{(Rabi frequency)}}}$$



What can go wrong?

$$\frac{\Gamma_{\text{(Line width)}}}{\Omega_{\text{(Rabi frequency)}}}$$

- Single PA line effect
- Flucutation
- Scattering



What can go wrong?

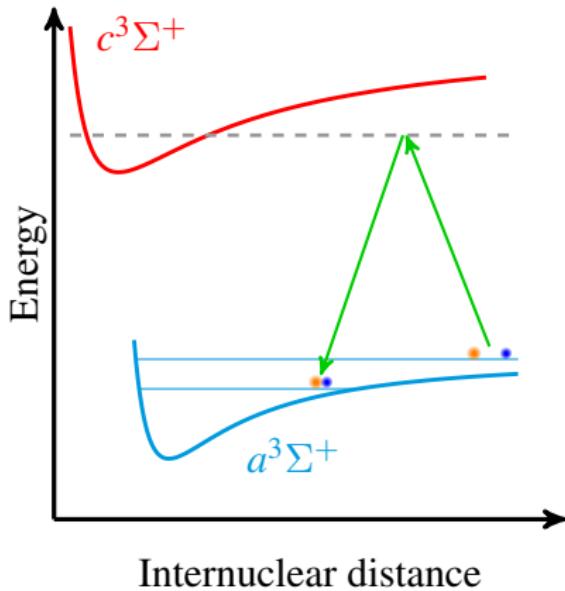
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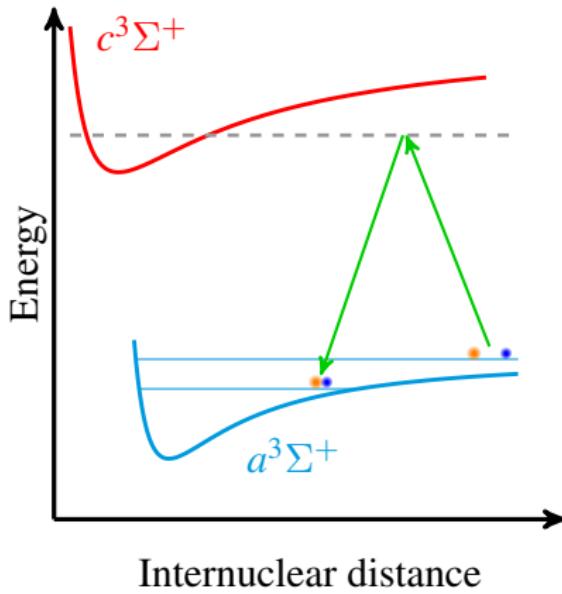
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What can go wrong?

$$\frac{\Gamma_{\text{(Line width)}}}{\Omega_{\text{(Rabi frequency)}}}$$

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How many photons?

Two photon scattering

- Stronger intensity than bulk gas
- Less accurate/no prediction
- Evidence from other group

Two photon scattering

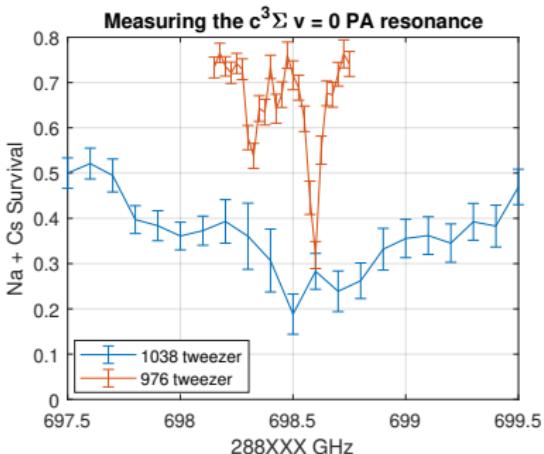
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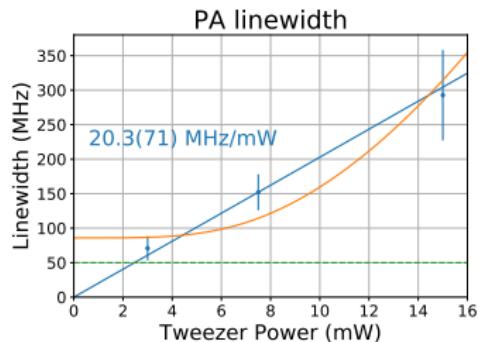
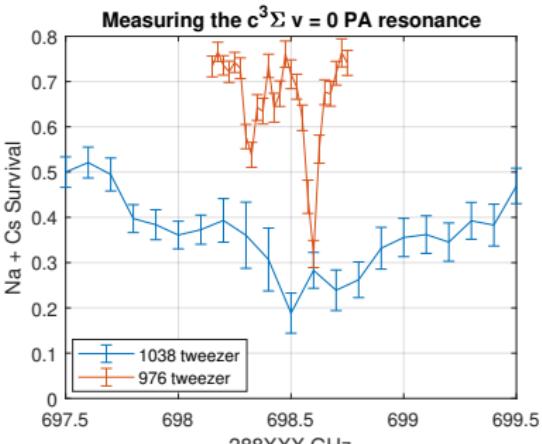
Two photon scattering

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Two photon scattering

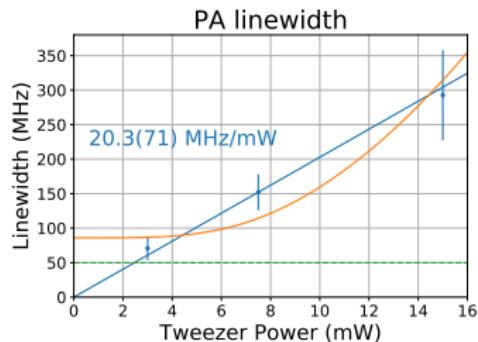
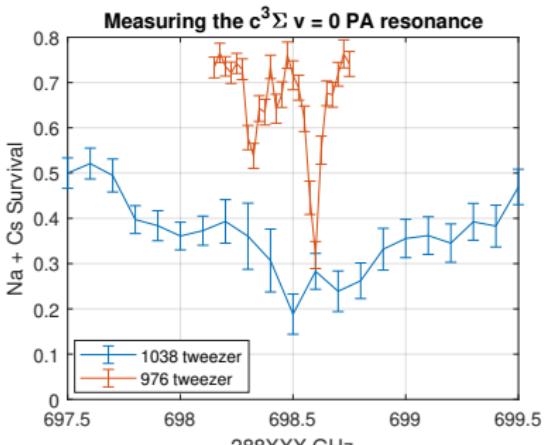
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Two photon scattering

Until ...

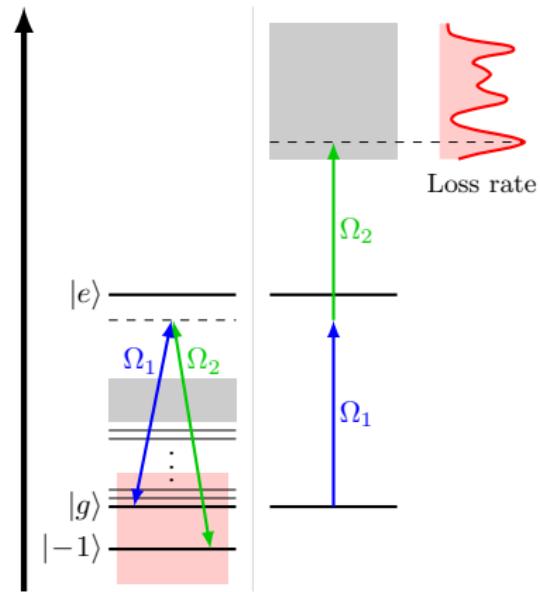
- Two photon up vs down
- One beam vs two beams
- Linear dependency on power for Raman line width



Two photon scattering

Until ...

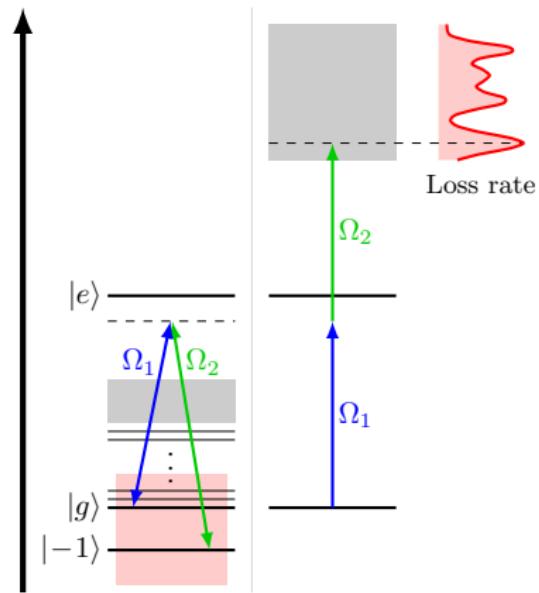
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Two photon scattering

Until ...

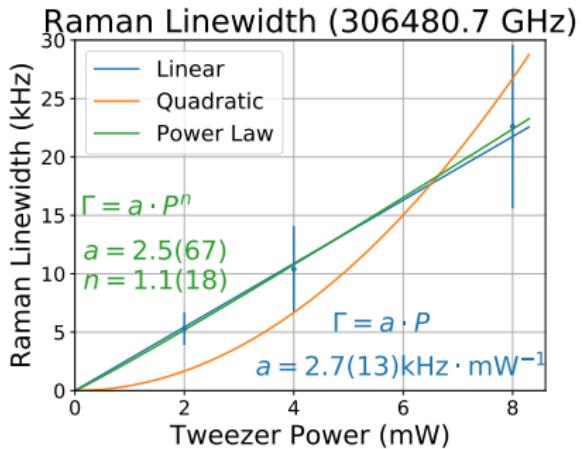
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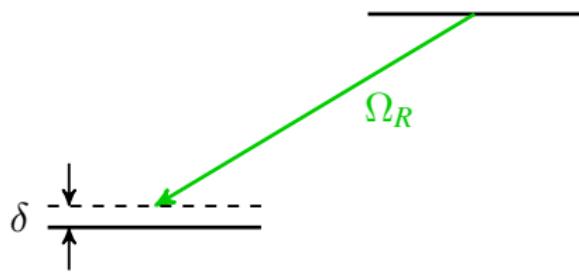


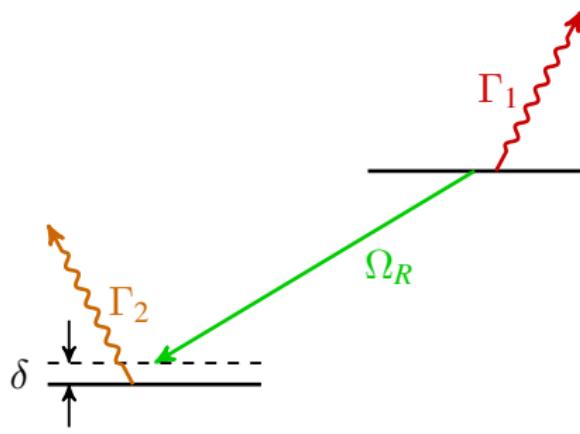
Two photon scattering

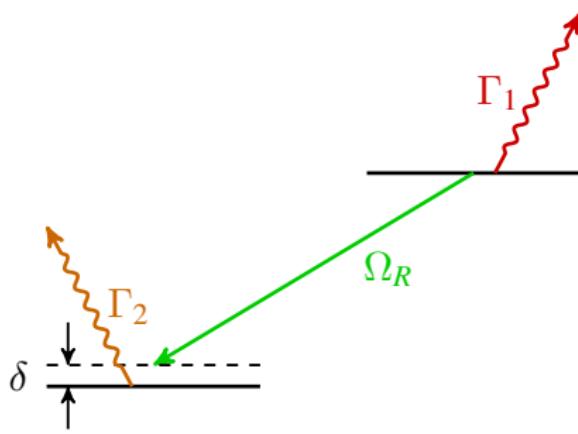
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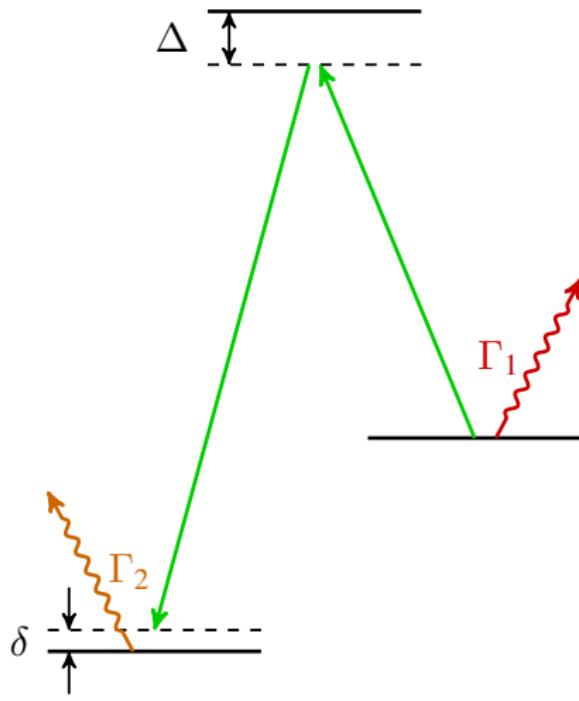


Γ_1 : PA rate

Γ_2 : Line width

Ω_R : Transfer/decay rate

δ : Resonance/line width

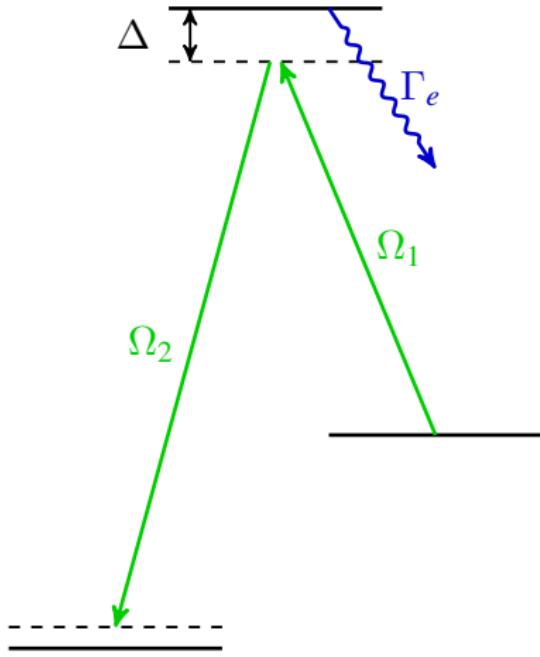


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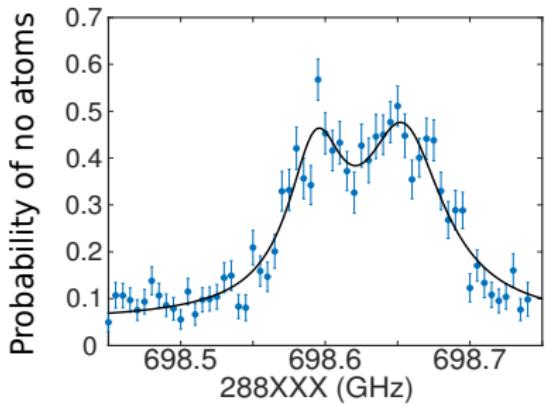
$$\Delta \rightarrow \Gamma_e \Omega_1 \Omega_2$$

- Rabi frequencies (Ω_R , Ω_1 , Ω_2) and light shift (δ_L) matches theory.
- Scattering is faster than expected.
- $\Gamma_e \approx 2\pi \cdot 300\text{MHz}$

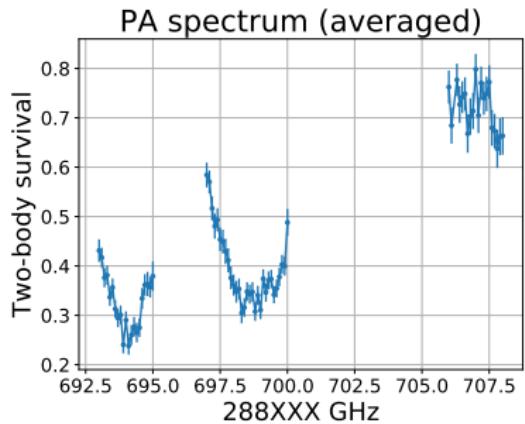
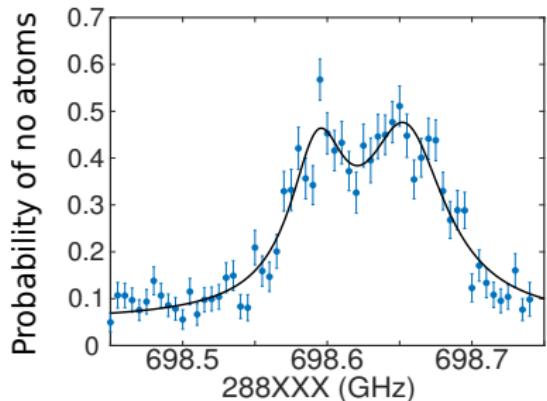
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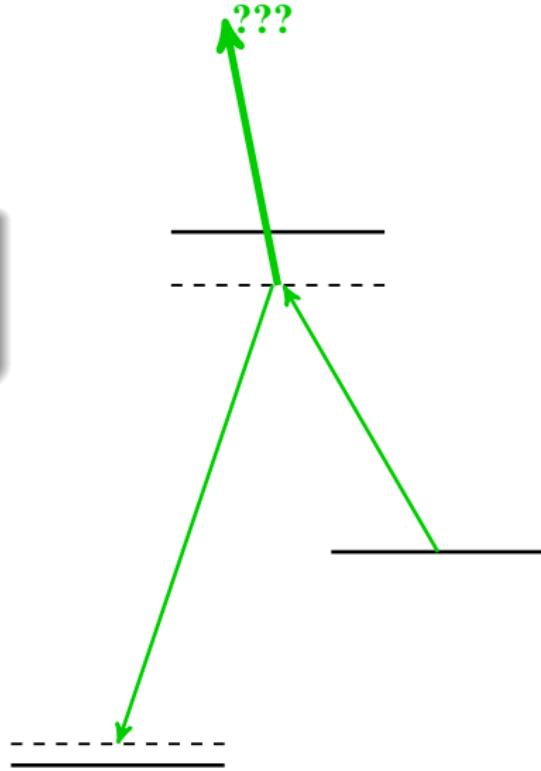


Cause

- PA beam size?
- Two photon process?

Cause

- PA beam size?
- Two photon process?



Cause

- PA beam size?
- Two photon process?

Alternative

- Different wavelength (976nm?)
- Different transfer path (singlet?)

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