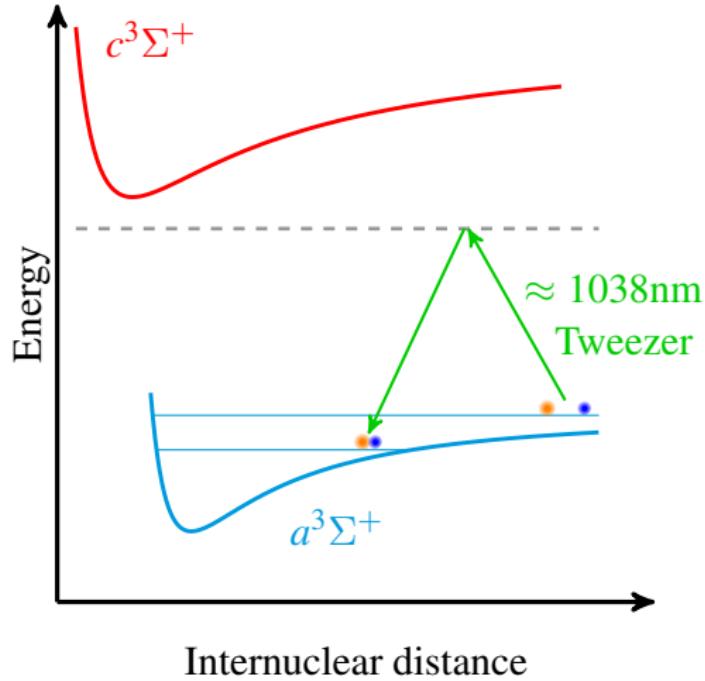


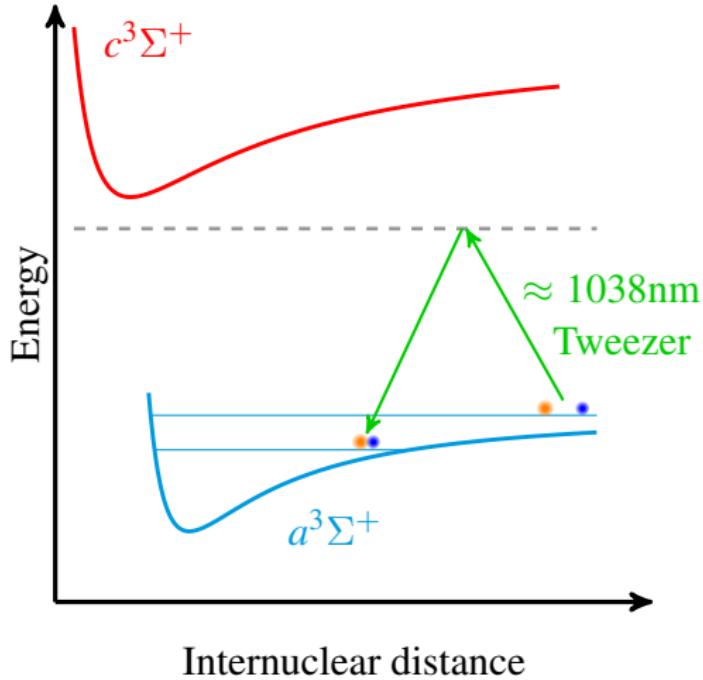
# NaCs lab update

Yichao Yu

Ni Group

Apr. 26, 2019





No Rabi oscillation

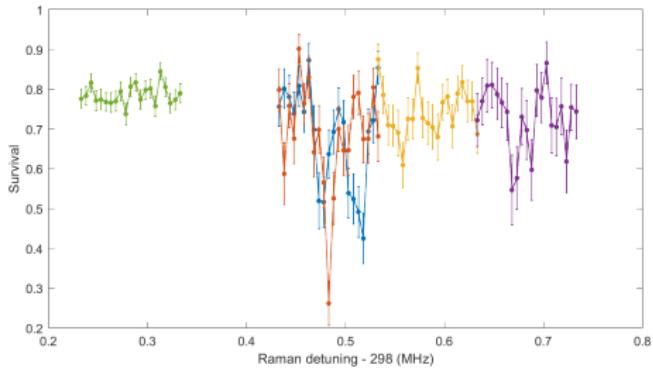


# What can go wrong?

## State

- Initial state (temperature)
- Final state

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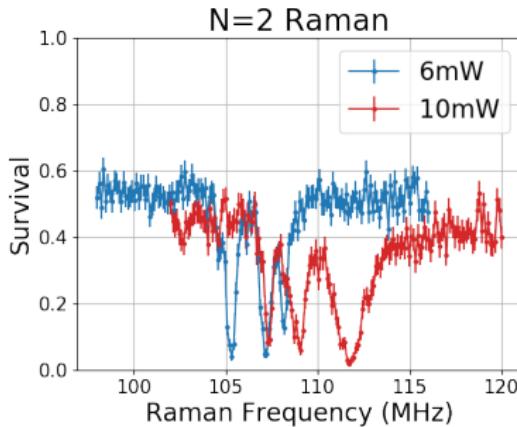
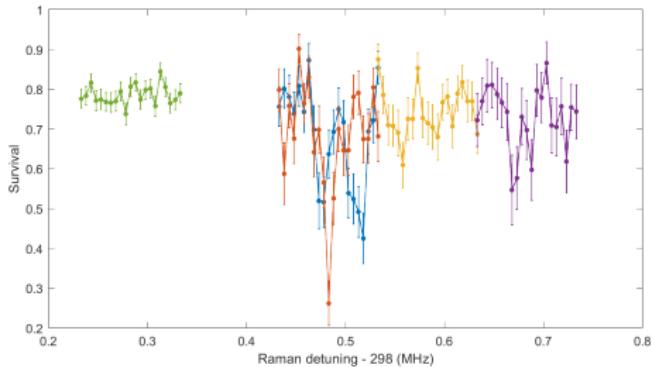
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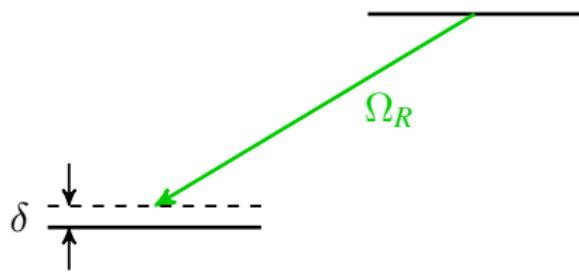
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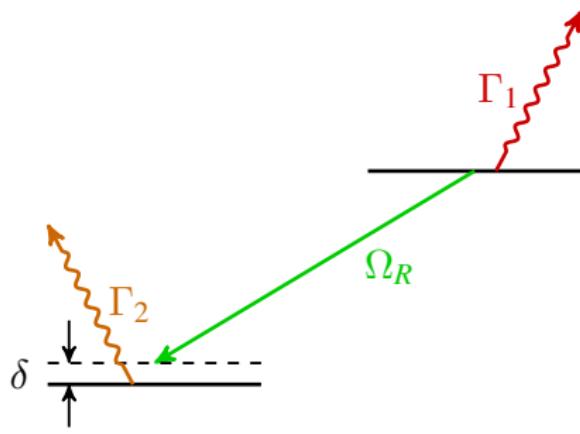
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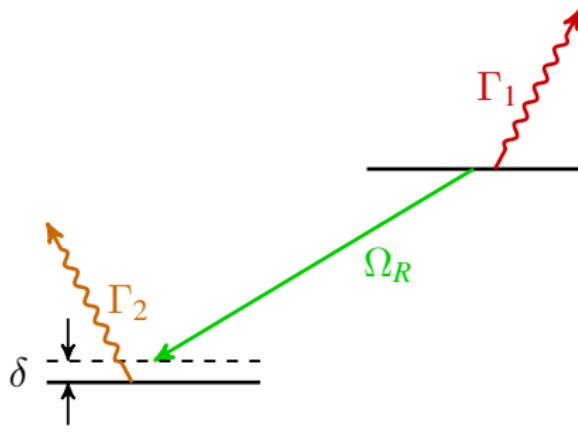
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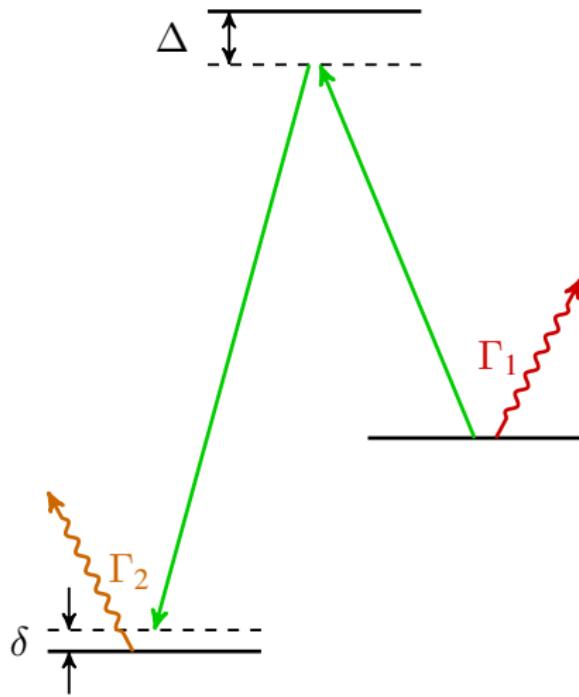


$\Gamma_1$ : PA rate

$\Gamma_2$ : Line width

$\Omega_R$ : Transfer/decay rate

$\delta$ : Resonance/line width

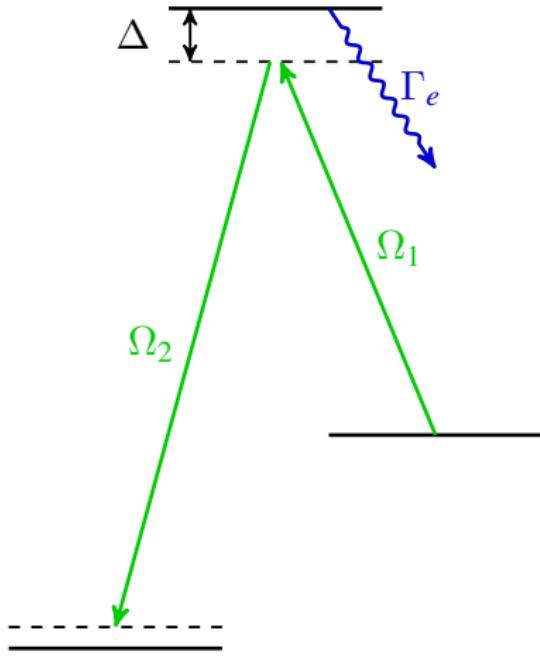


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$$\Delta \rightarrow \Gamma_e \Omega_1 \Omega_2$$

## Detuning fluctuation

- Raman Rabi rate  $\Omega_R \propto \frac{\Omega_1 \Omega_2}{\Delta}$

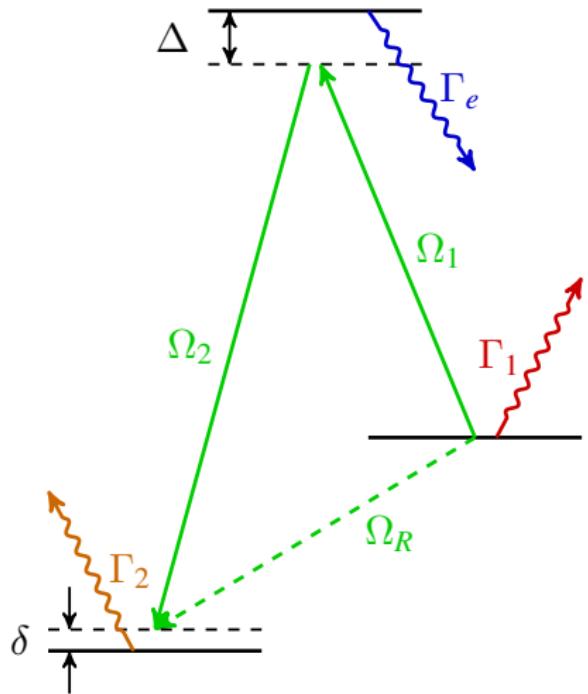
- Light shift  $\delta_L \propto \frac{\Omega_1^2 + \Omega_2^2}{\Delta}$

- For  $\Omega_2 \gg \Omega_1$

$$\frac{\delta_L}{\Omega_R} \approx \frac{\Omega_2}{\Omega_1} \gg 1$$

- Raman linewidth

$$\Gamma_2 \propto \frac{1}{\Delta^2} \text{ or } \frac{\delta_L}{\Gamma_2} \propto \Delta$$



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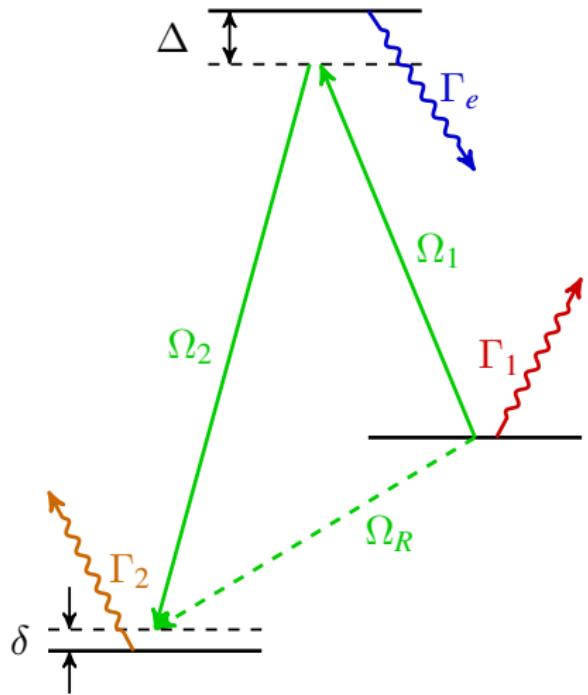
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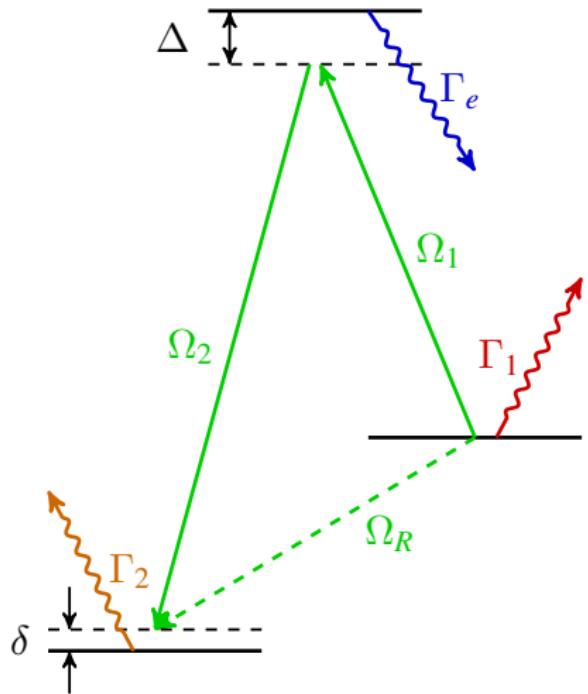
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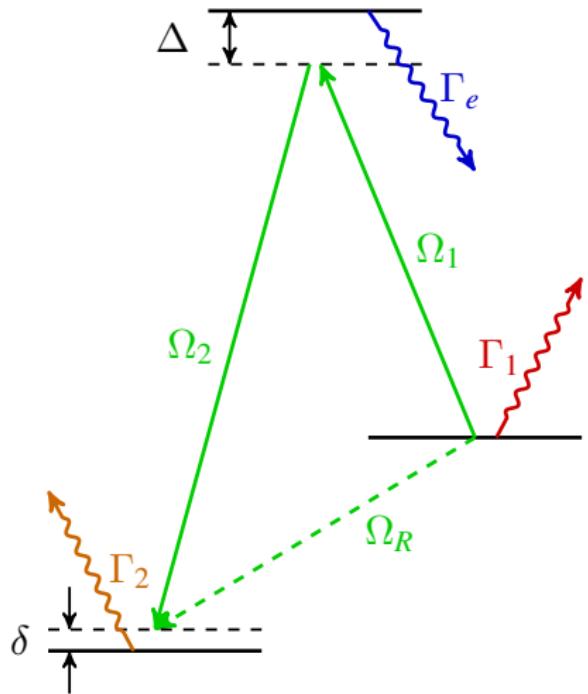
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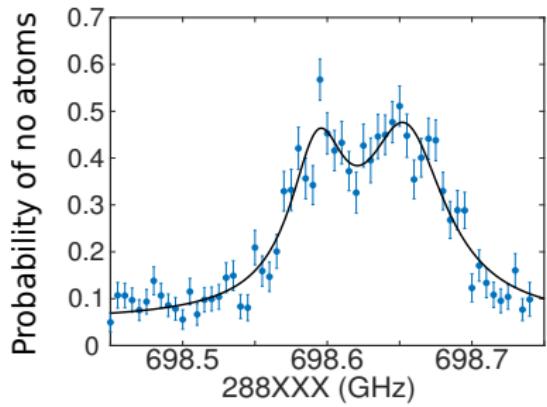


- Rabi frequencies ( $\Omega_R$ ,  $\Omega_1$ ,  $\Omega_2$ ) and light shift ( $\delta_L$ ) matches theory.
- Scattering is faster than expected.
- $\Gamma_e \approx 2\pi \cdot 300\text{MHz}$

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