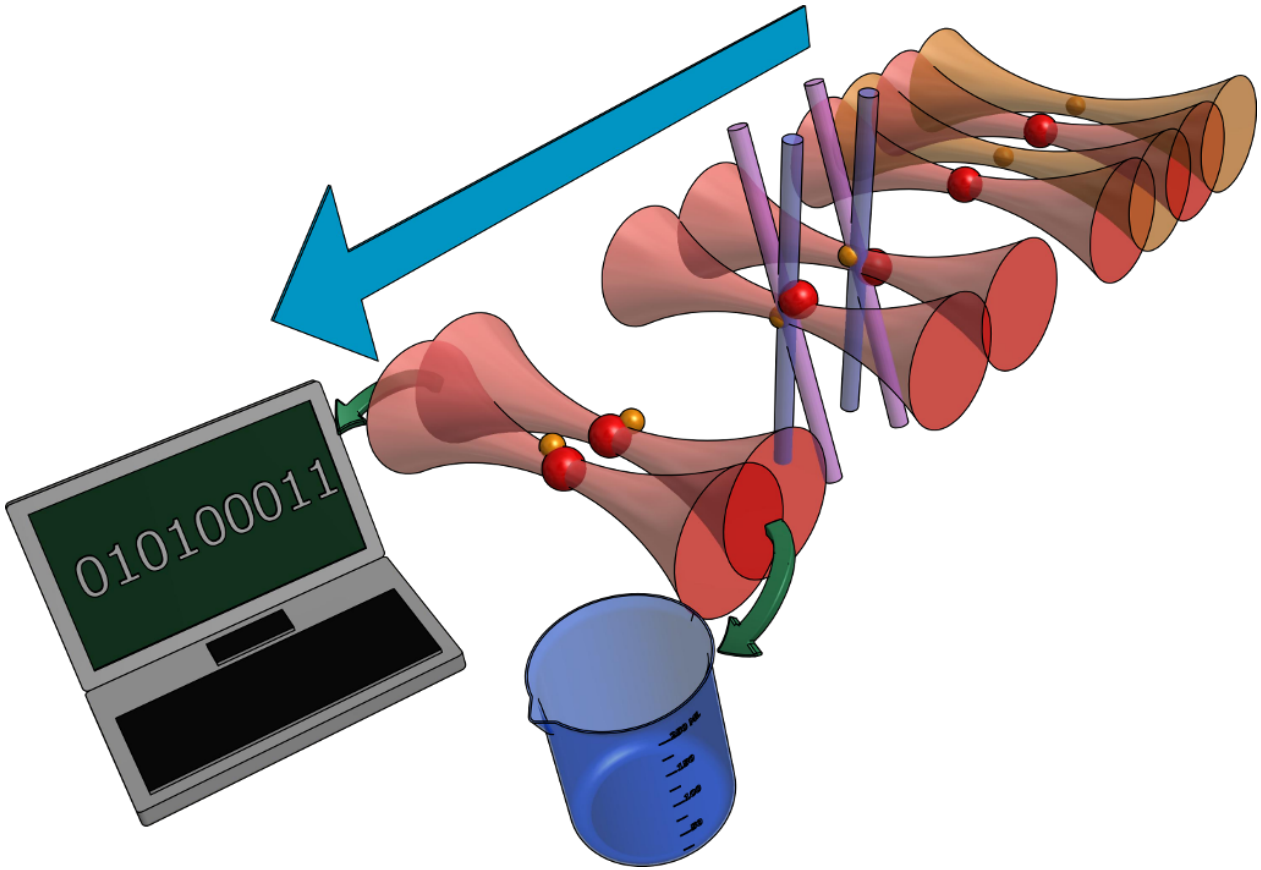
Trapping and imaging of single atom in the present of light shift



Yichao Yu
May 26, 2016
Ni Group/Harvard

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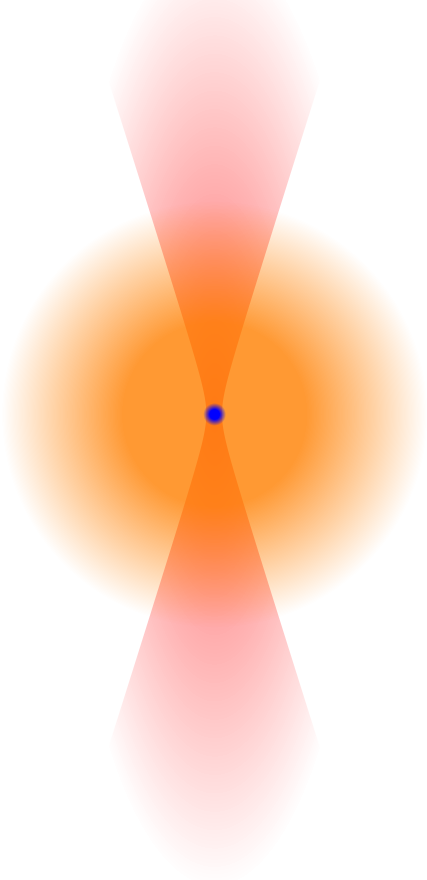
Tweezer



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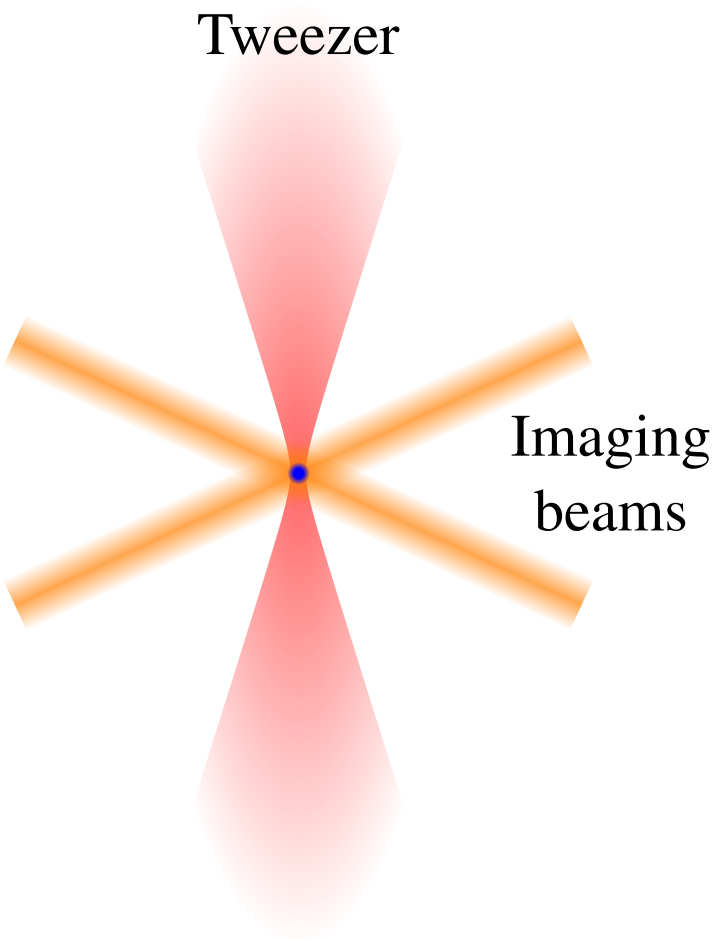

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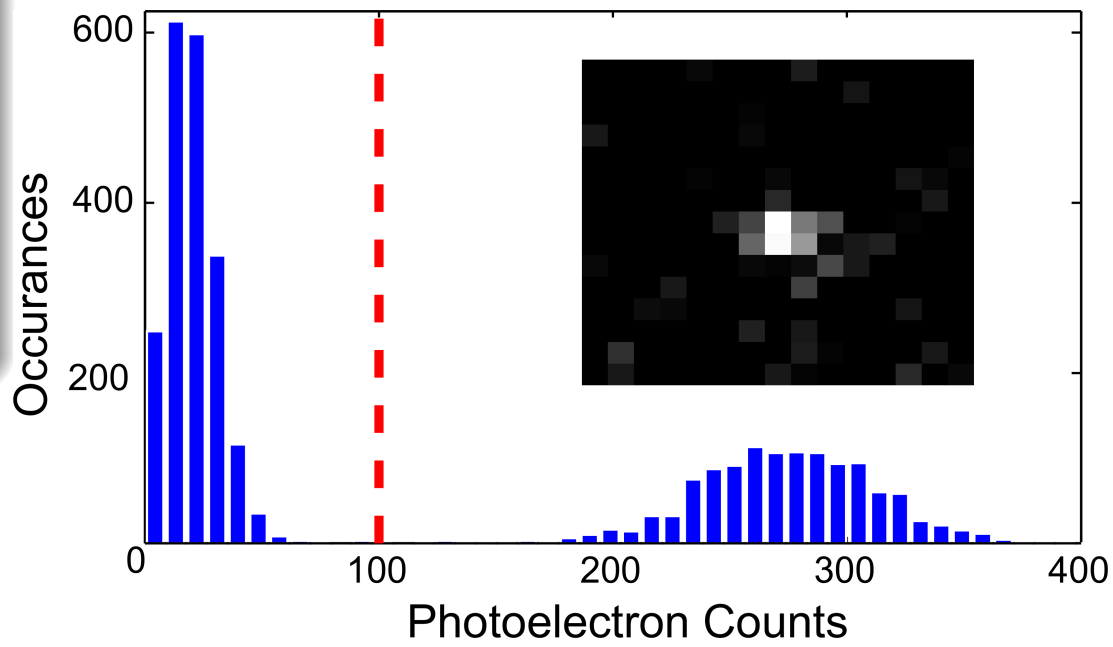

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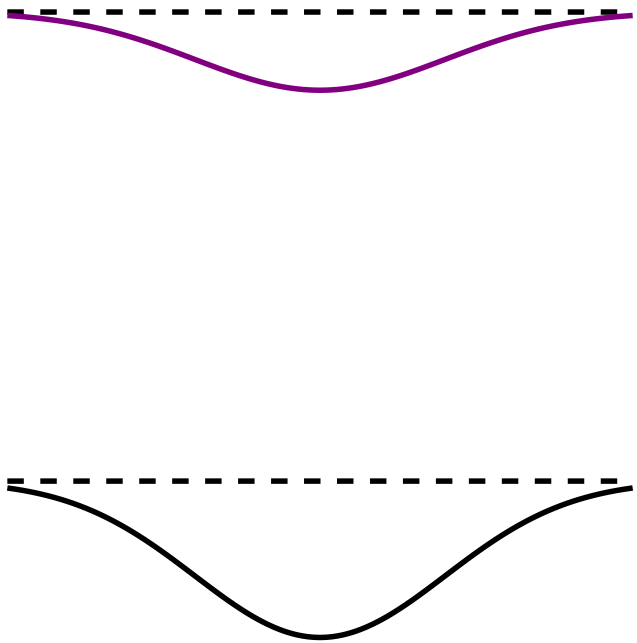
Light shift

- $\beta = \dfrac{\alpha_e}{\alpha_g}$
- Inefficient cooling; Heating
- Shift imaging light out of resonance



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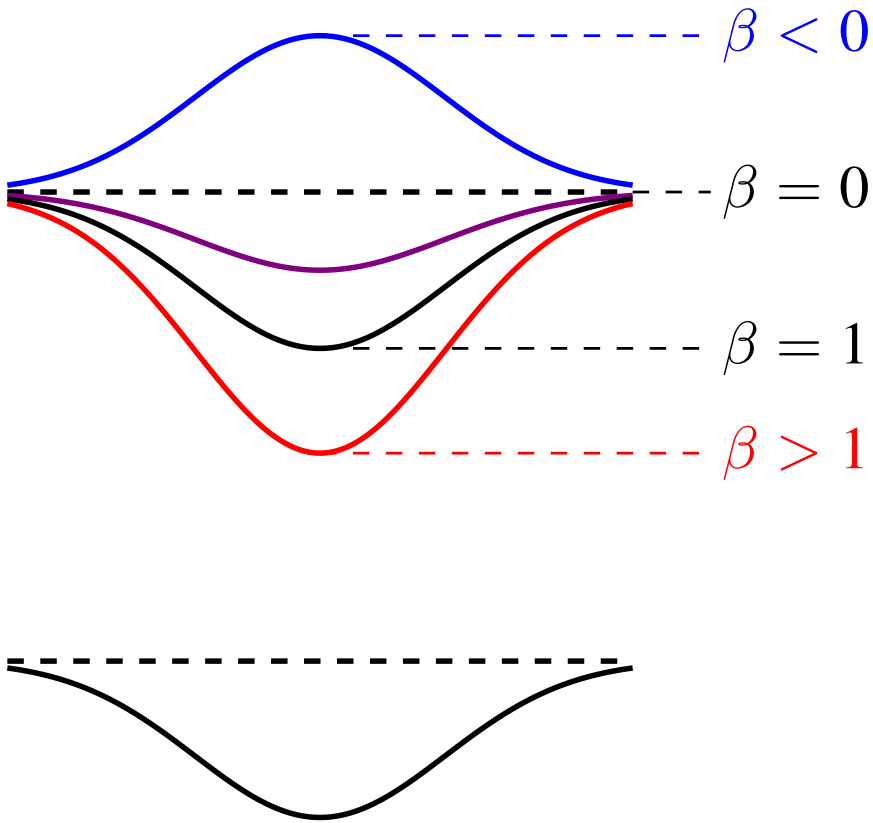

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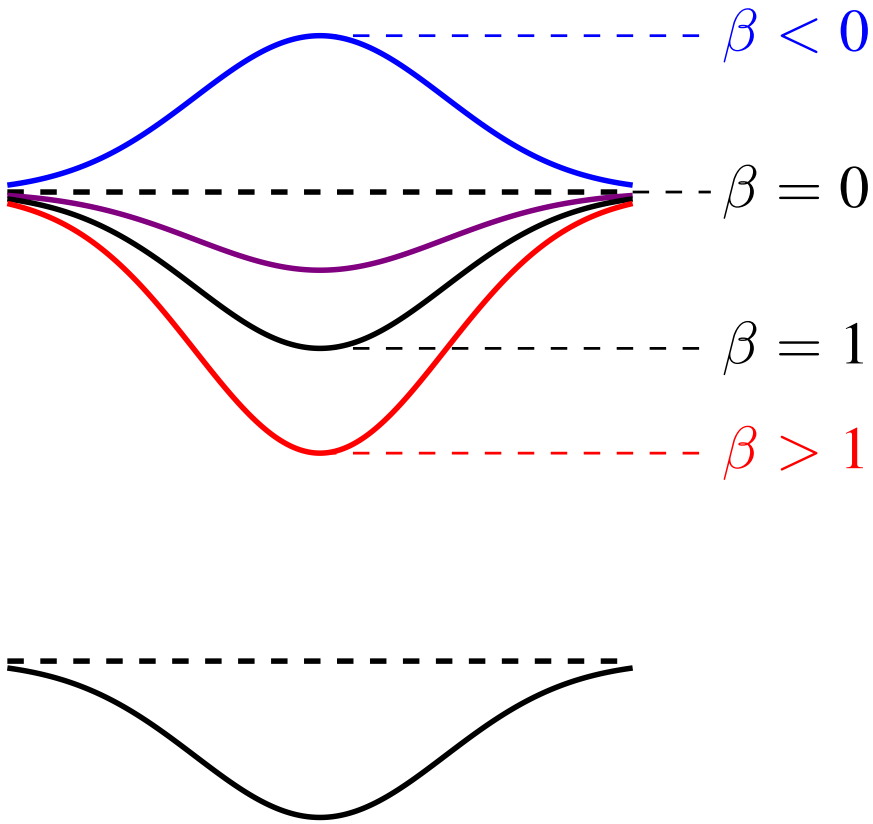

Atom	Cs			Na
λ_{trap}	922	935	970	700
β_{cycle}	2	1	0.6	-1

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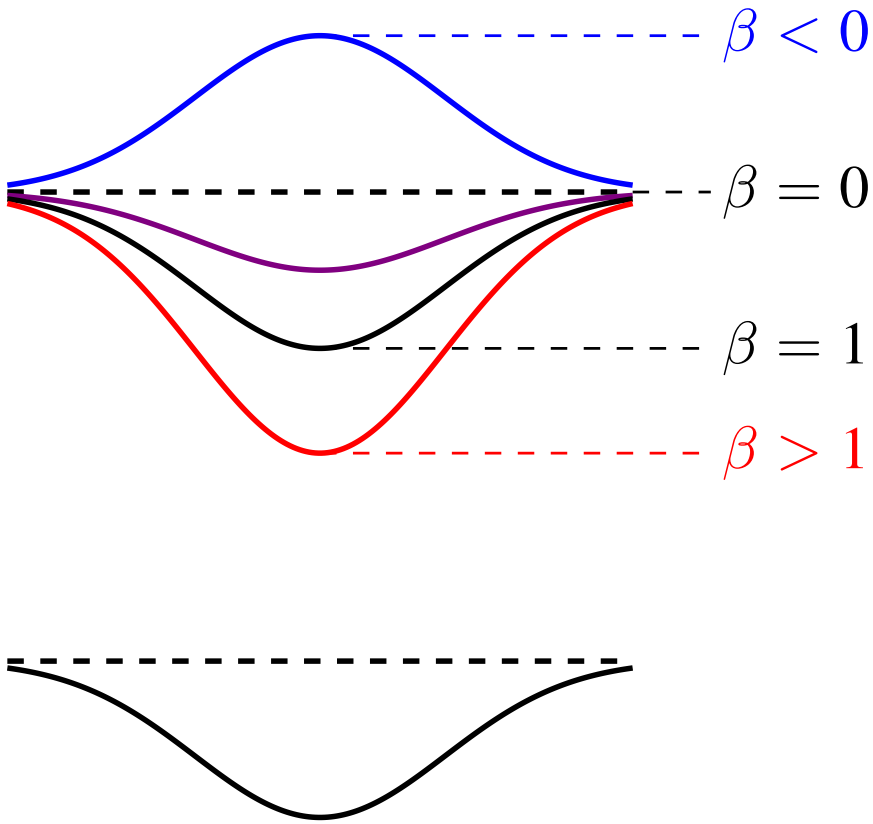

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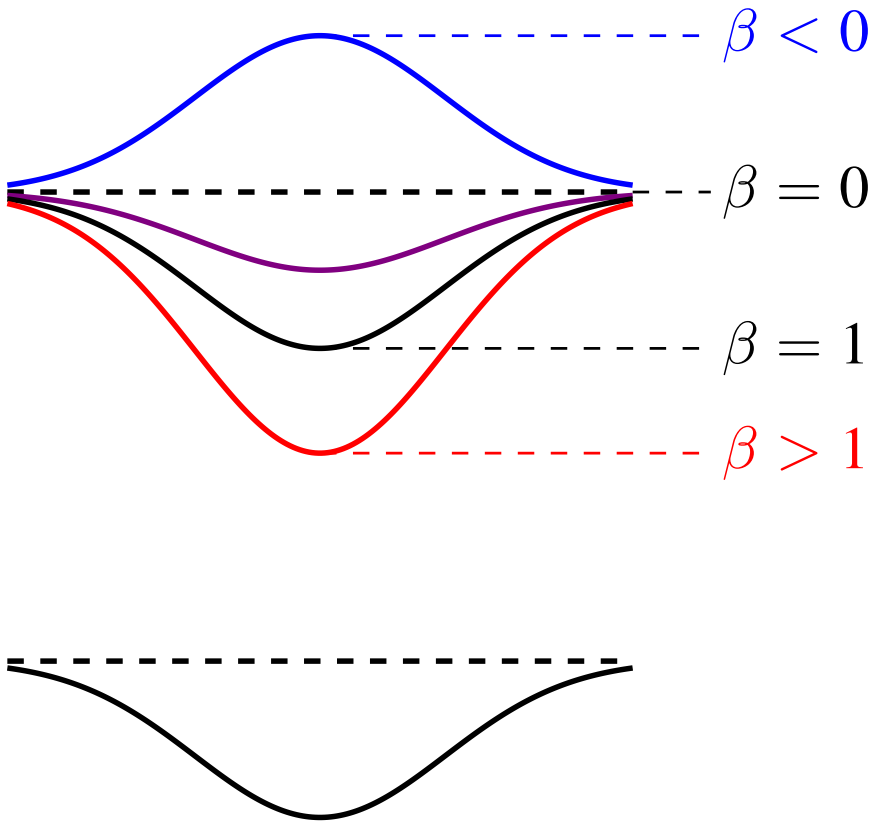

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Cs single atom loading

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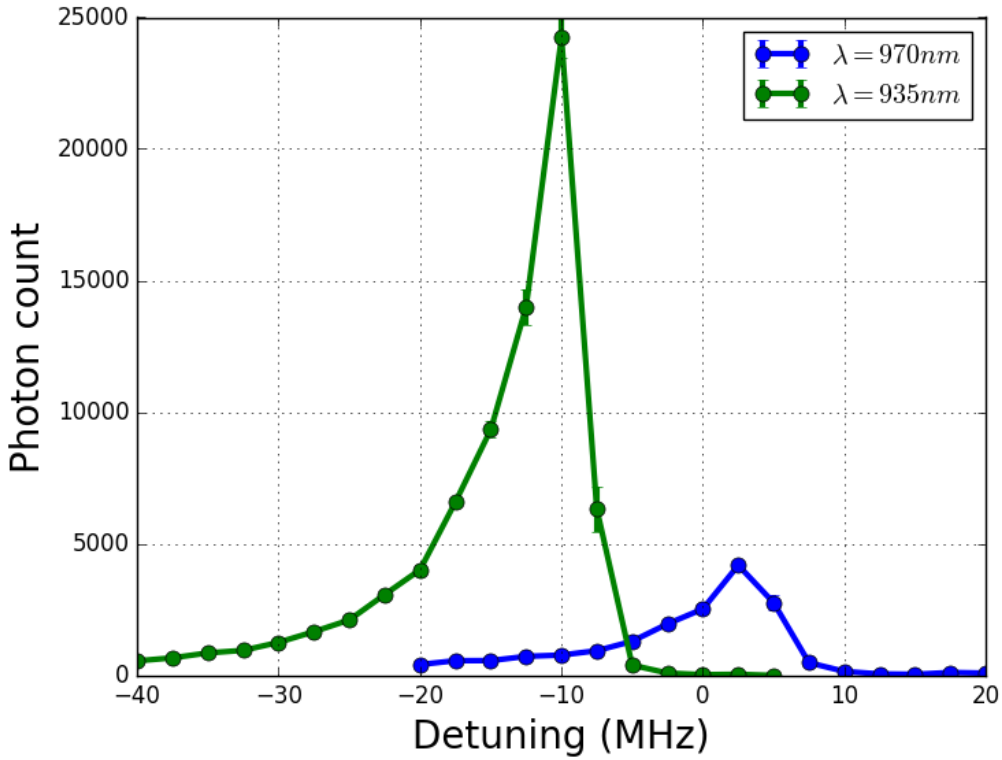
Loading %	0	≈ 50	≈ 50

Cs single atom imaging



Trap switching

- Alternate between resonant and trap light
- Switching at $1 - 3$MHz
  $f_{trap} = 10 \sim 400$kHz
  $\Gamma = 2\pi \times 5 \sim 10$MHz
- Being able to load single Na atom

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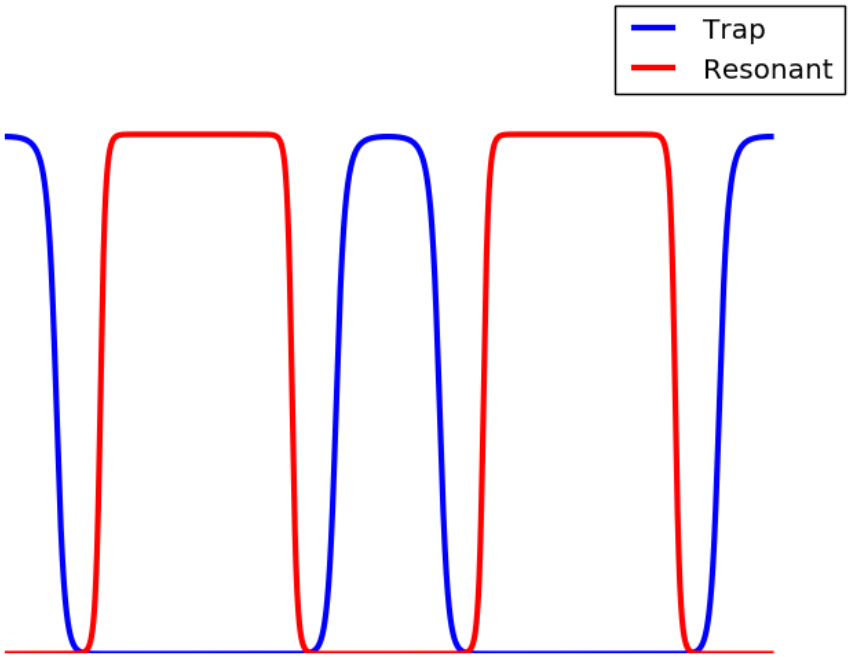

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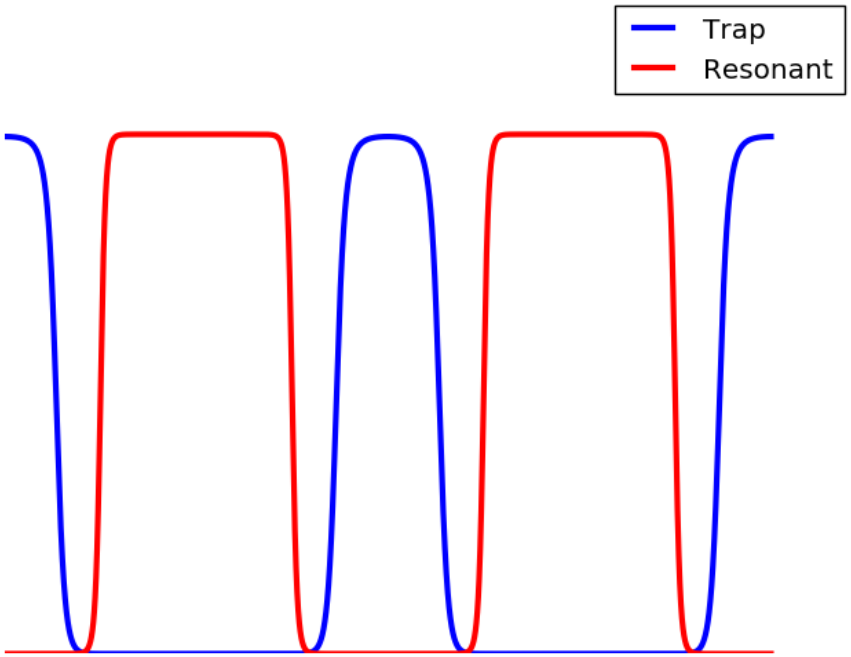

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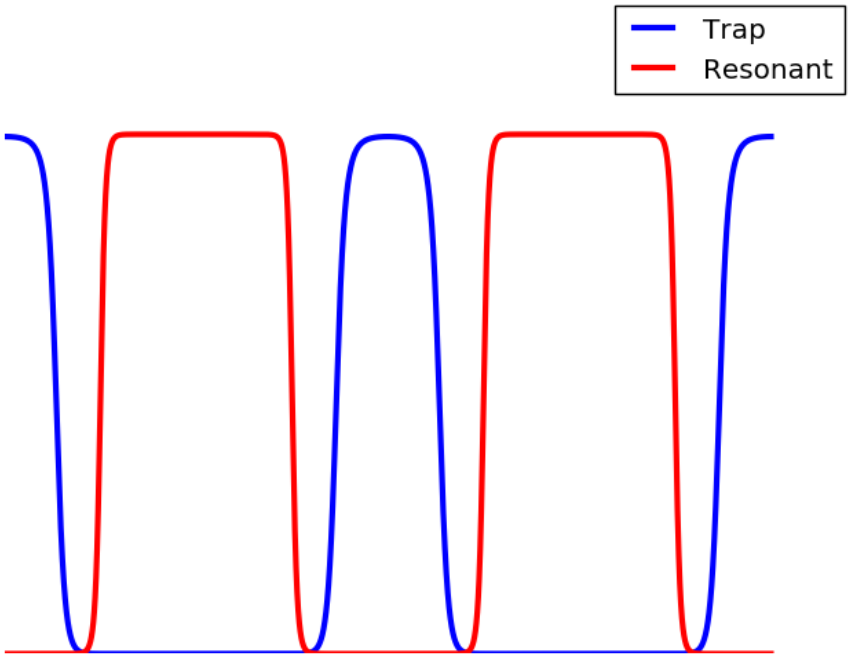

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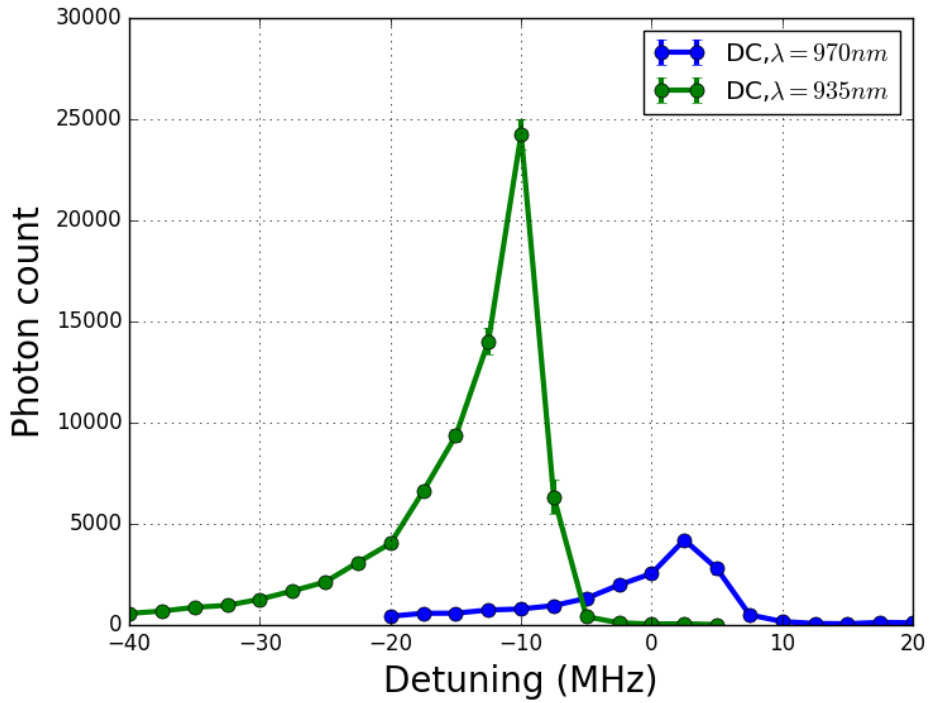

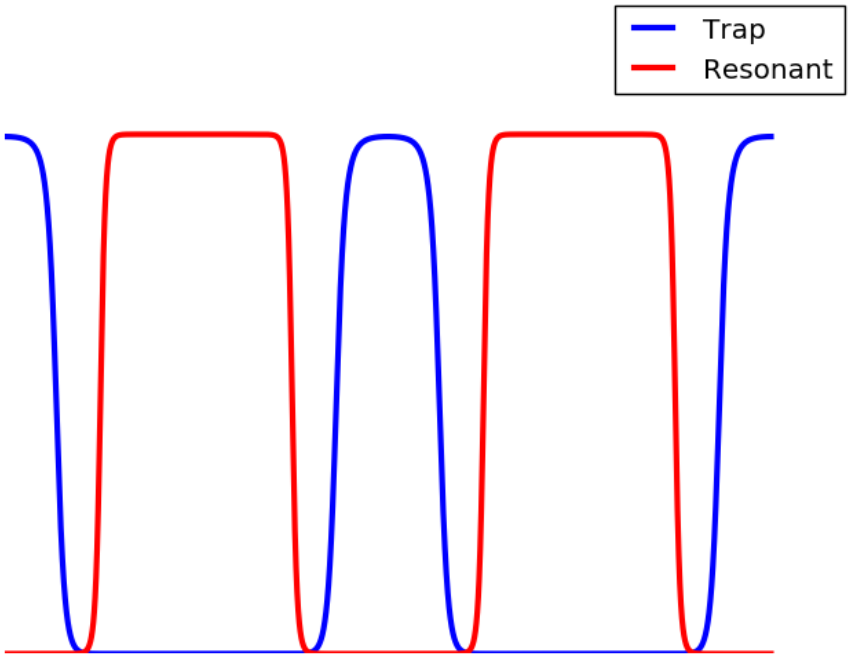

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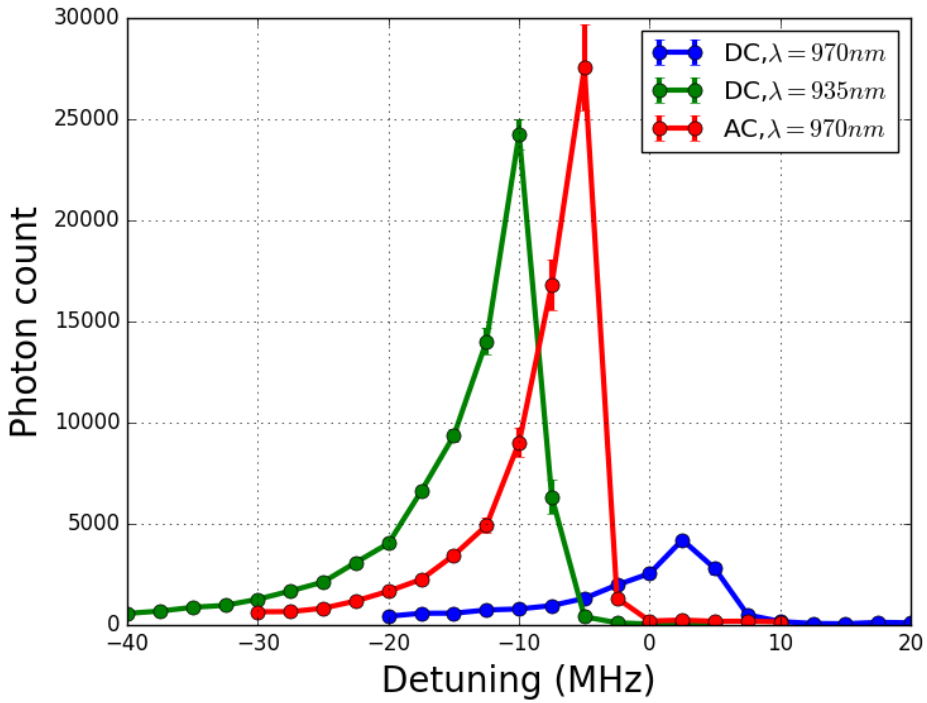

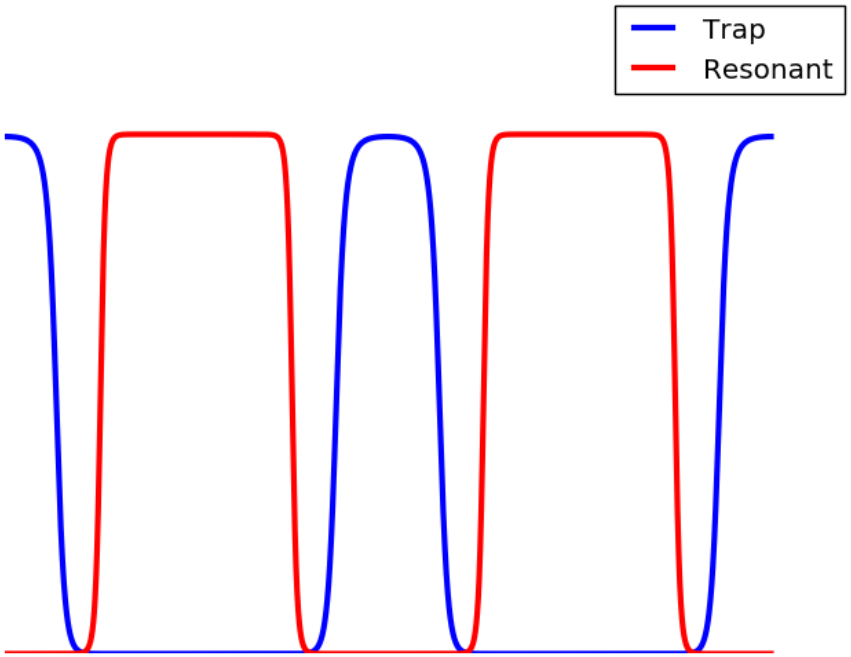

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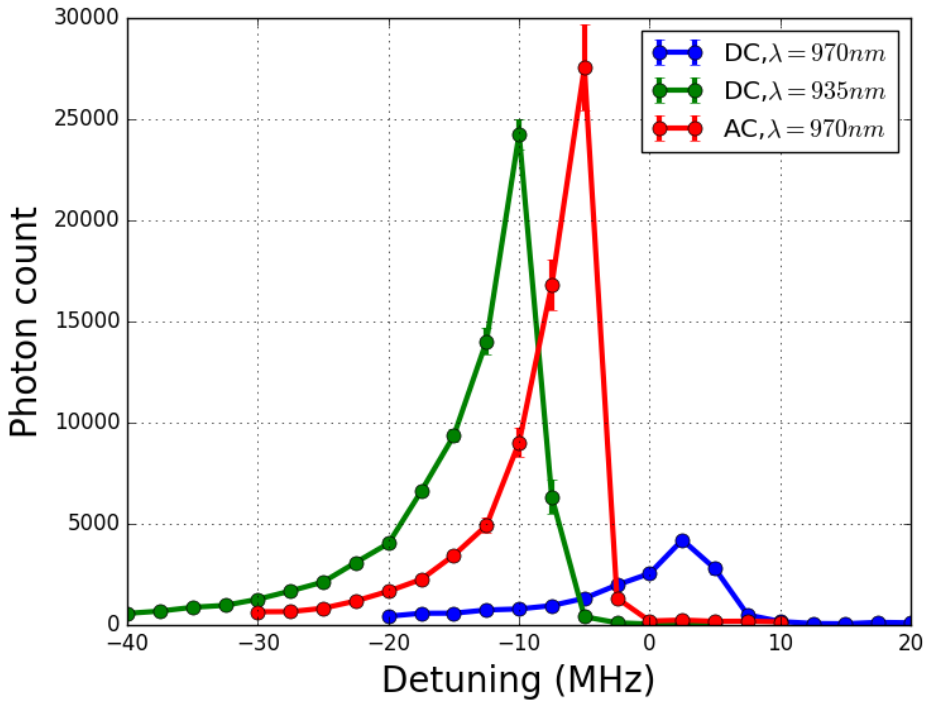

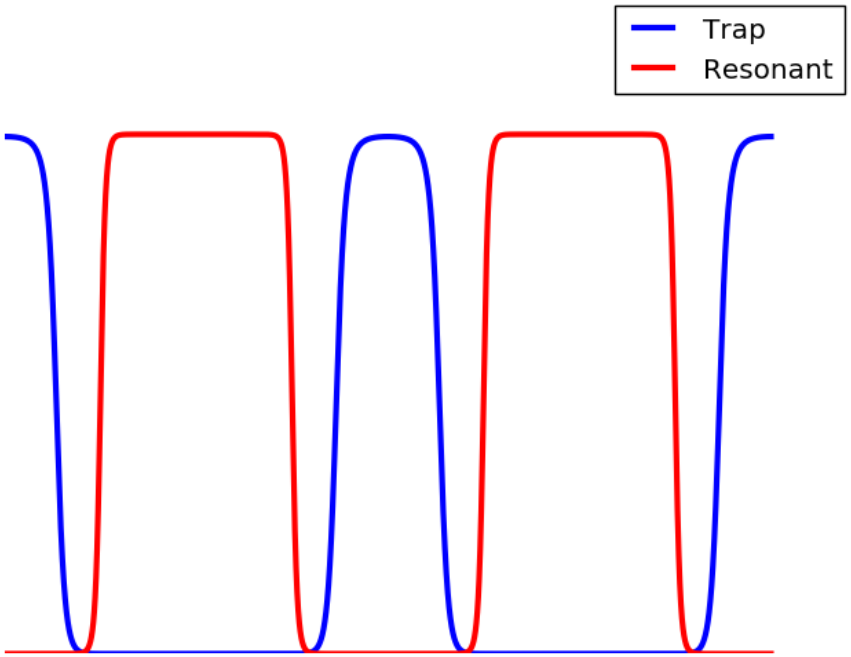

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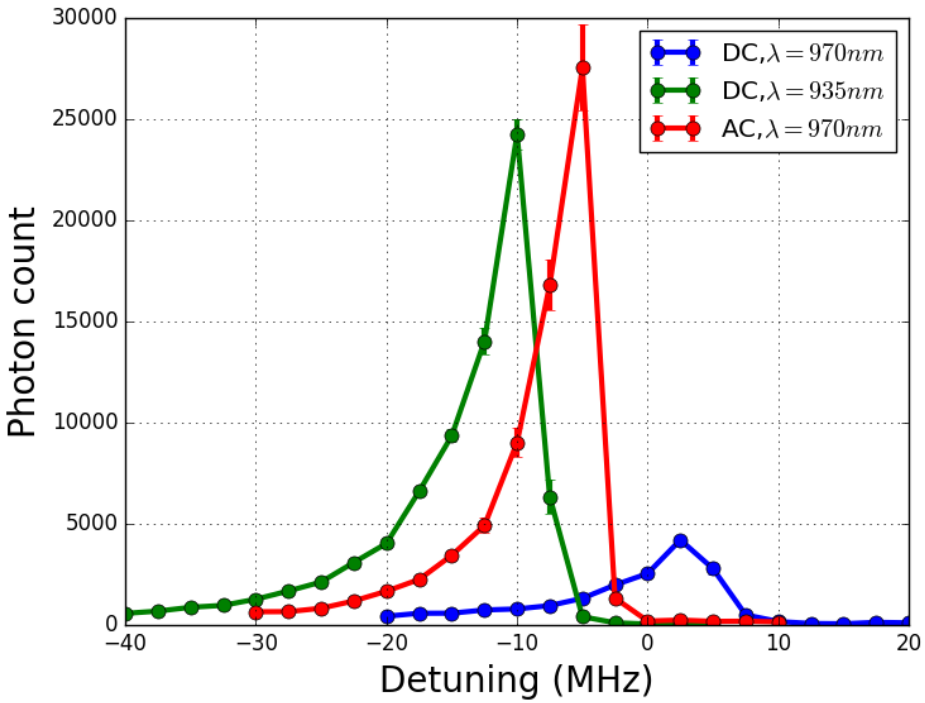

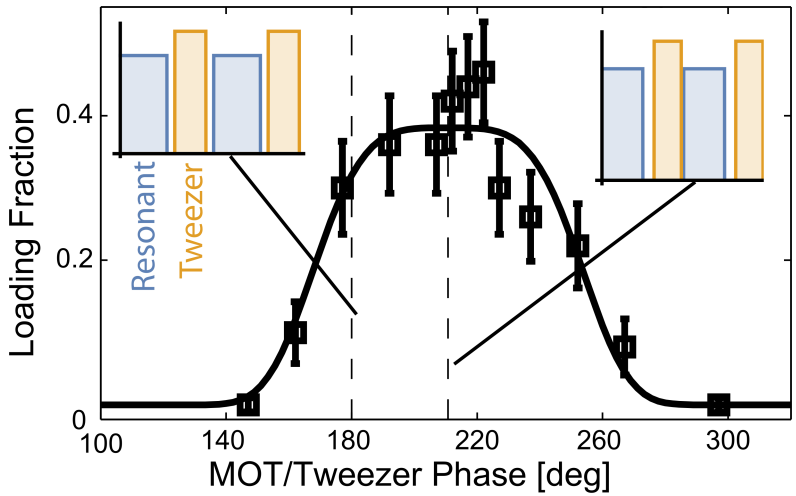

Conclusion

- Measured the effect of light shift on loading and imaging of single atom
- Overcome the light shift by alternating trapping and resonant light to achieve loading of single Na atom.