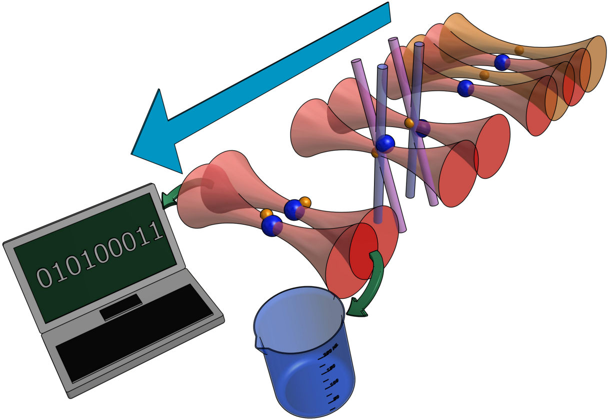
Trapping and imaging of single atoms in the presence of light shift



Yichao Yu
May 26, 2016
Ni Group/Harvard

Group members

Nicholas Hutzler

Lee Liu

Jessie Zhang

PI

Kang-Kuen Ni

Procedure

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- Works for Cs
- Doesn’t work for Na

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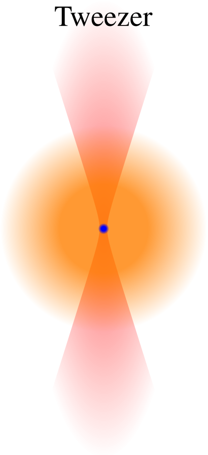

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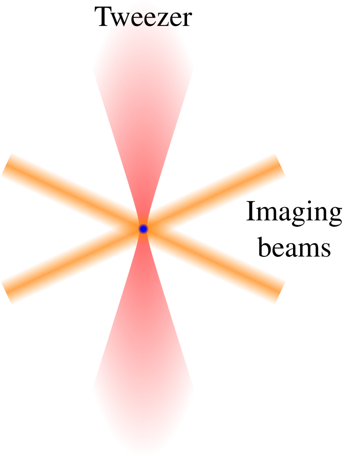

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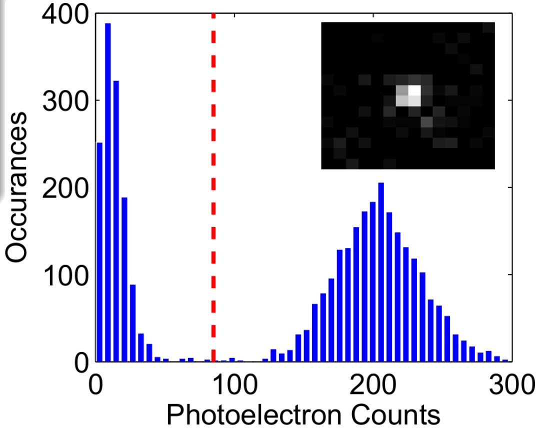

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Light shift

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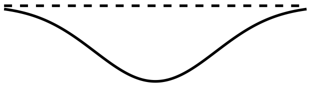
- Shift imaging light out of resonance



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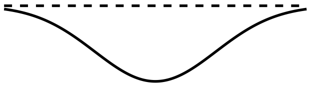

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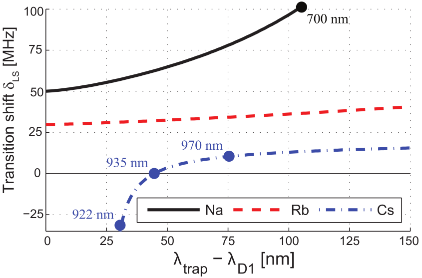

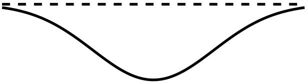

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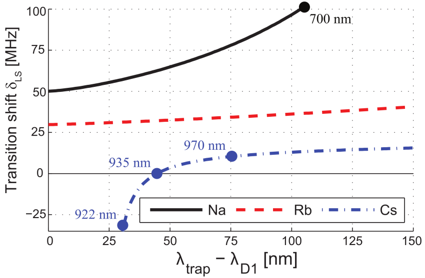

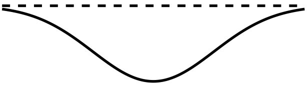

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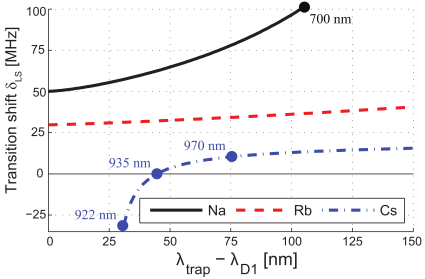

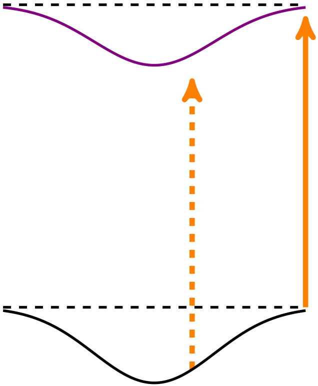

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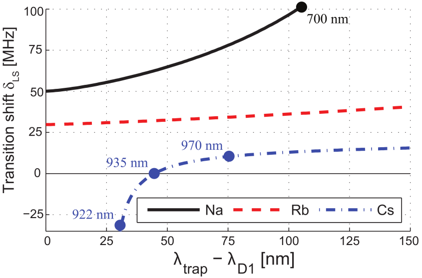

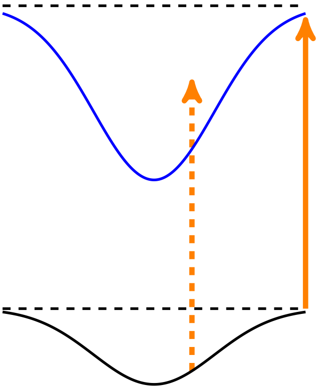

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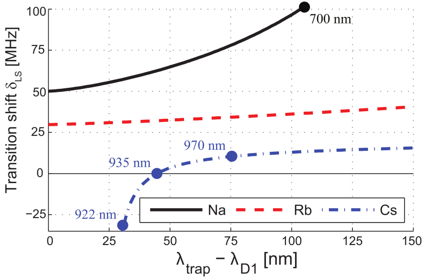

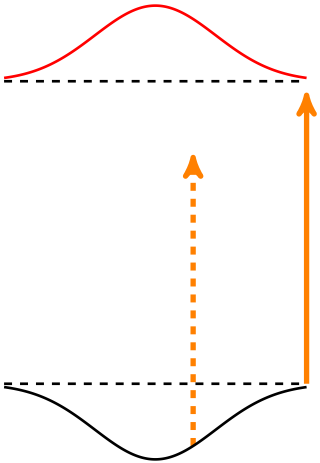

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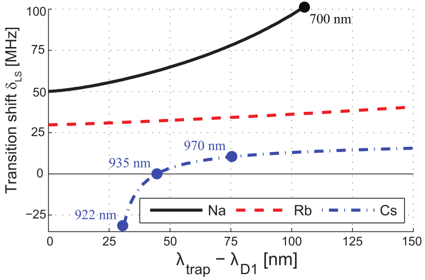
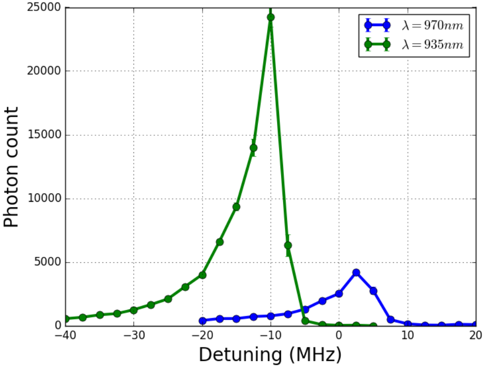
Cs single atom loading

$\lambda_{trap}(nm)$	922	935	970
Loading (%)	0	≈ 50	≈ 50



Cs single atom imaging

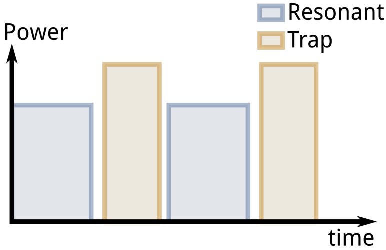


Trap modulation

Alternate between trap and resonant (cooling and imaging) light at $1 \sim 3$ MHz

$f_{trap} = 10 \sim 400$ kHz

$\Gamma = 2\pi \times (5 \sim 10)$ MHz



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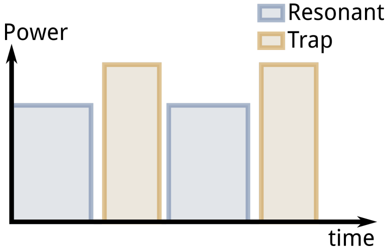

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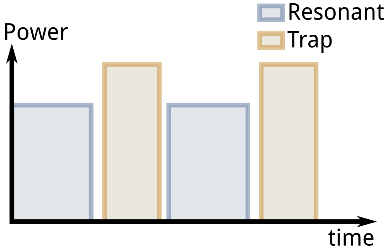

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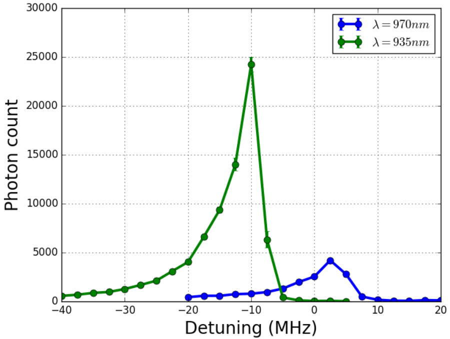

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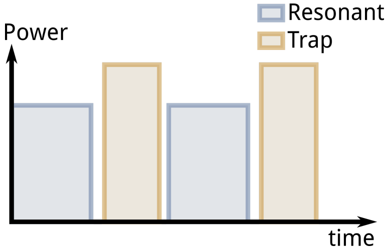

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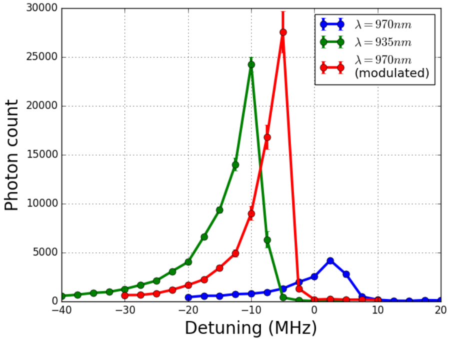

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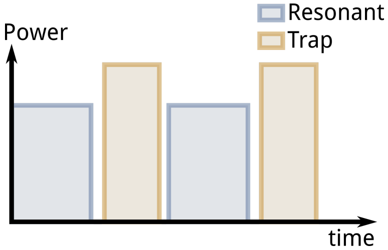

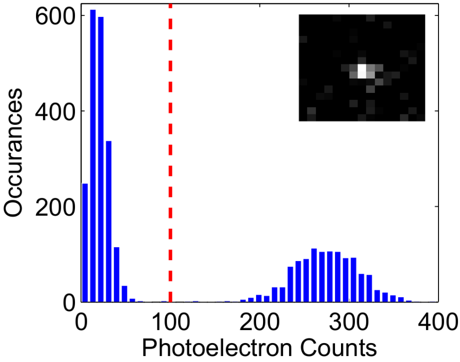

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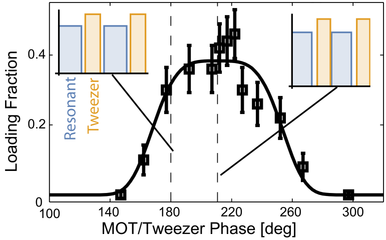

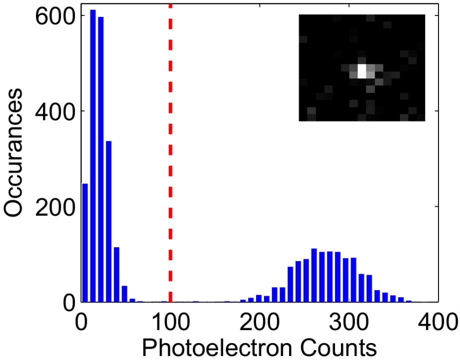

Na Single Atom Loaded!!

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.
- Generalizable to other species