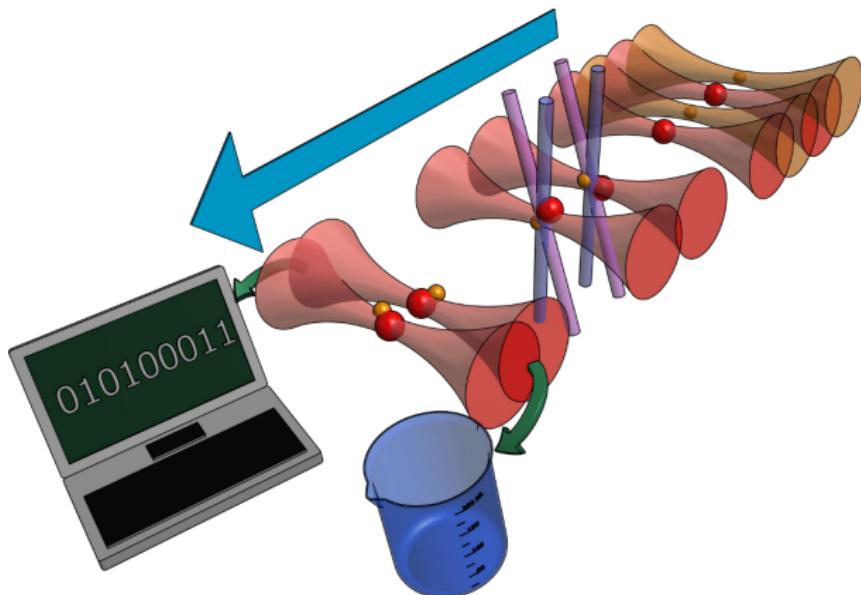


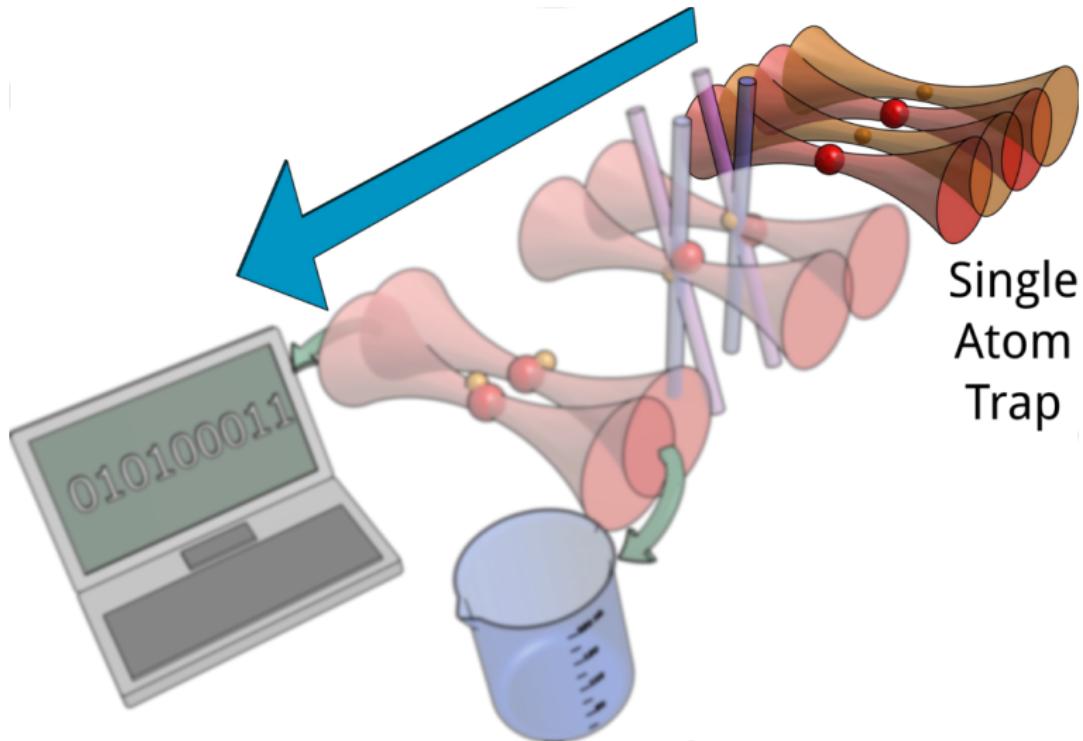
Polar Molecule Express

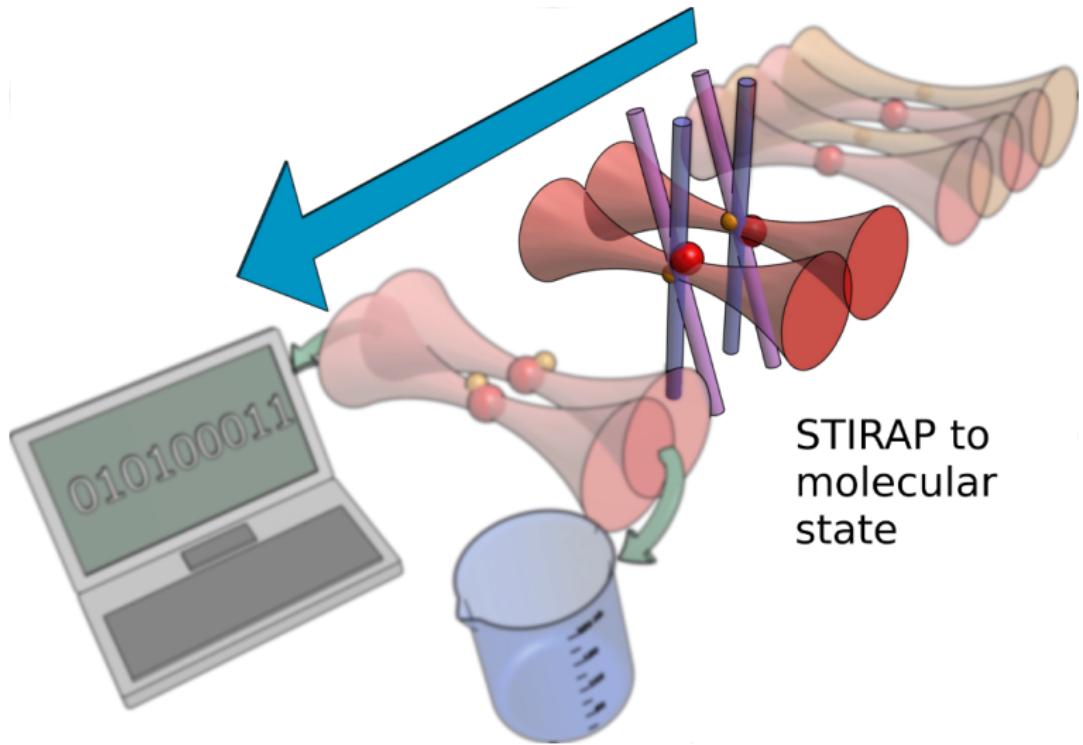


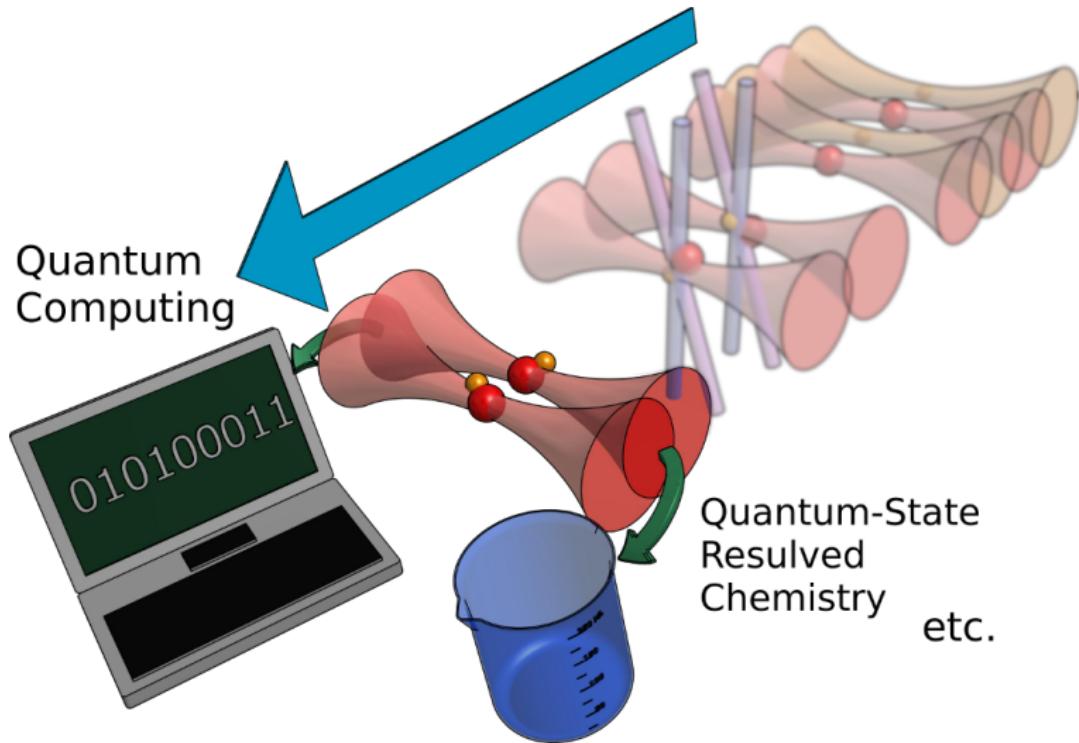
Yichao Yu

May 5, 2015

Ni Group/Harvard







Current state: Atom cooling

Cesium



Current state: Atom cooling

Cesium

MOT

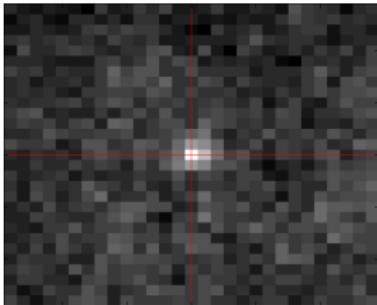


Current state: Atom cooling

Cesium

MOT

Trapping
single
atom



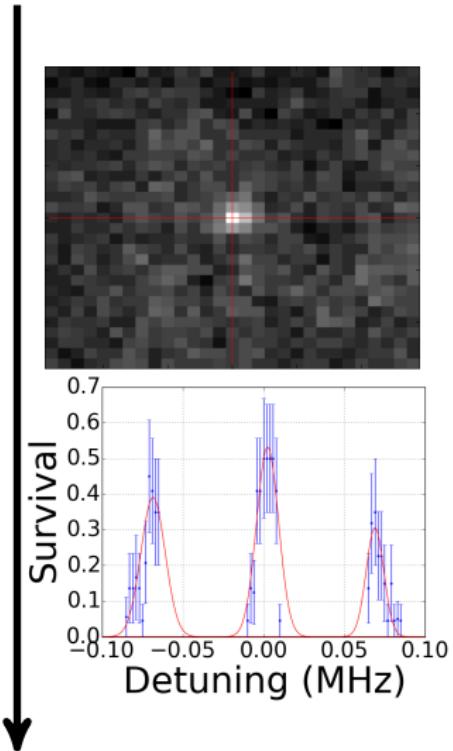
Current state: Atom cooling

Cesium

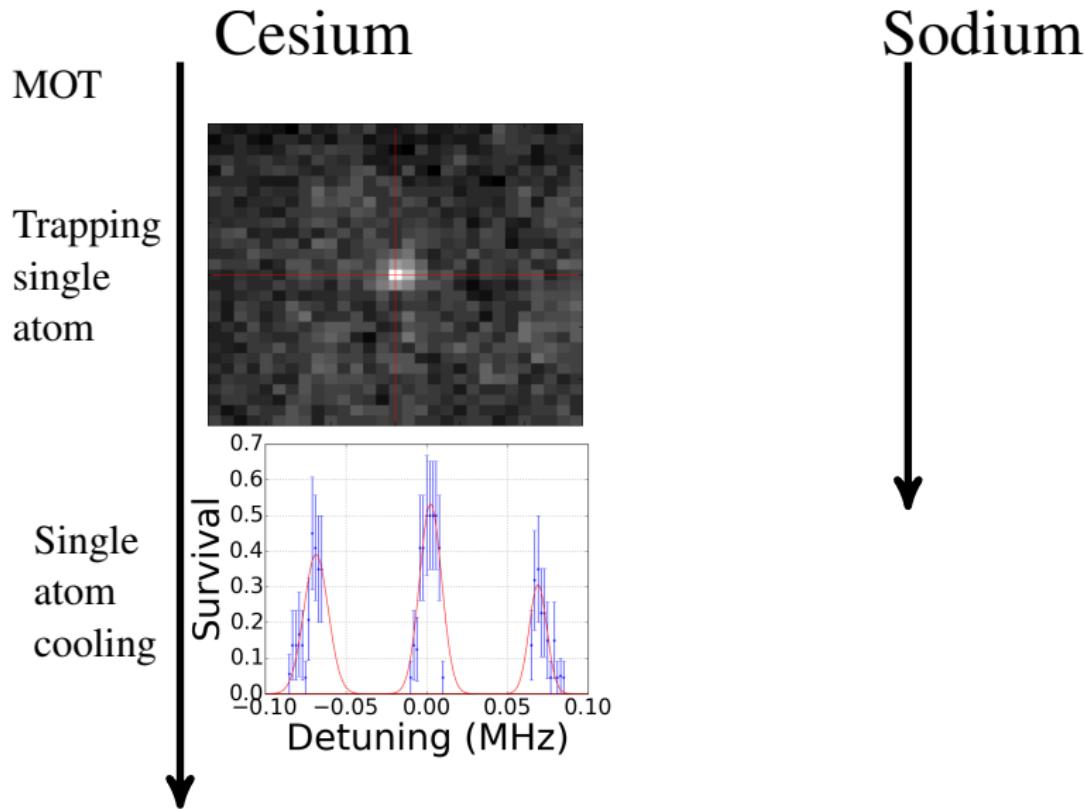
MOT

Trapping
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atom

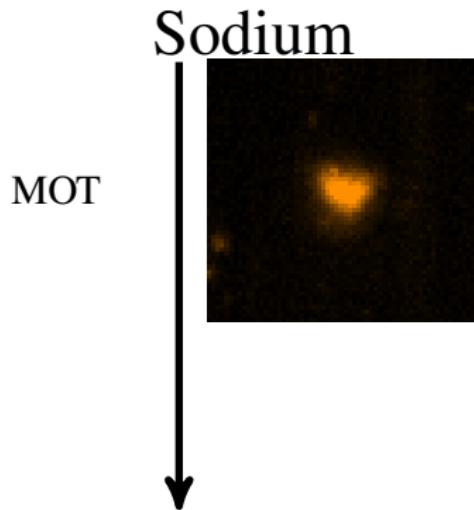
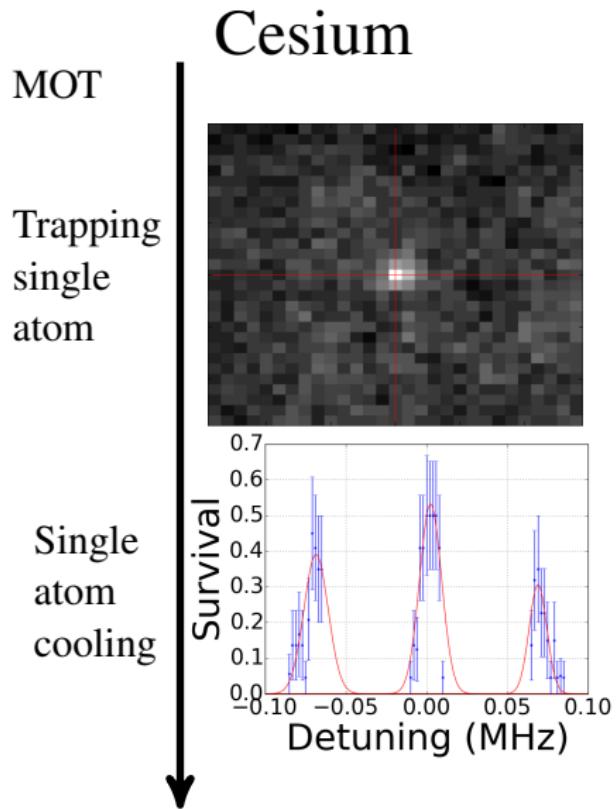
Single
atom
cooling



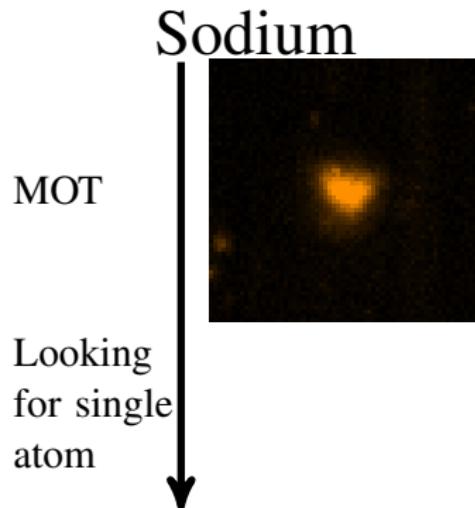
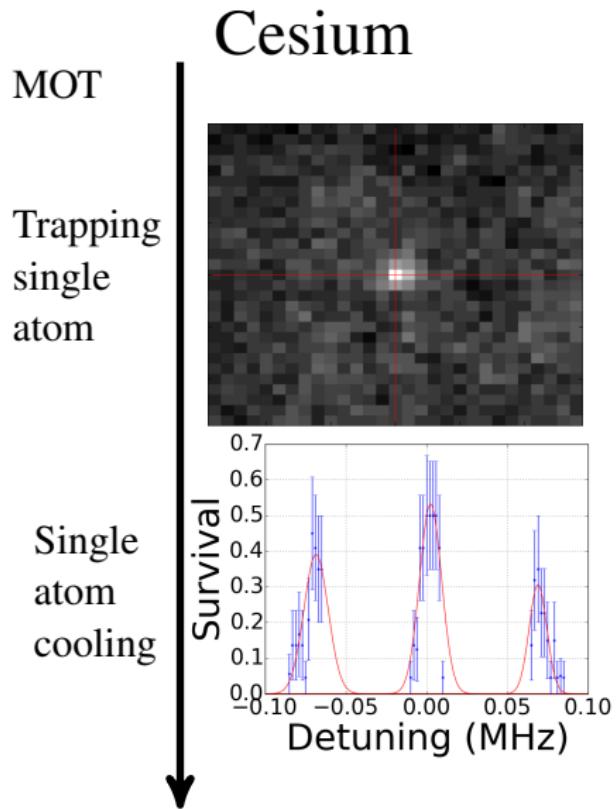
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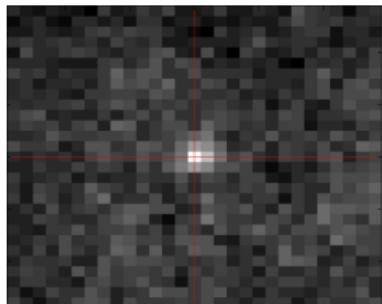
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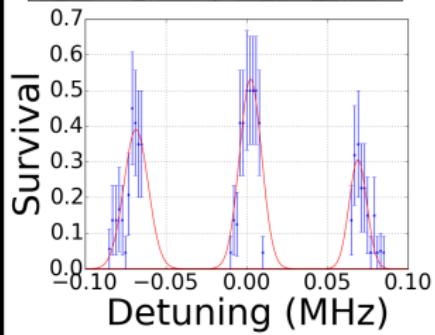
Cesium

MOT



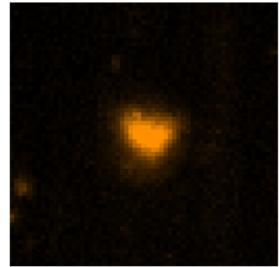
Trapping
single
atom

Single
atom
cooling



Sodium

MOT



Looking
for single
atom

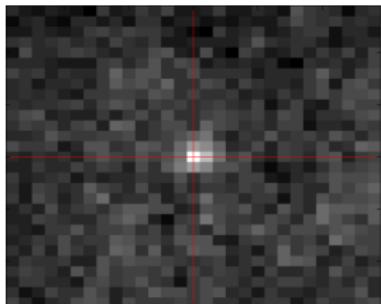
Challenges

- Sodium laser
- MOT stability

Current state: Atom cooling

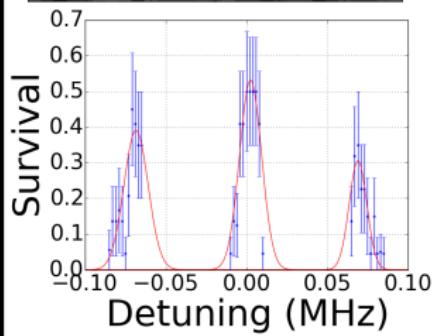
Cesium

MOT



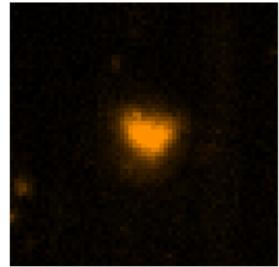
Trapping
single
atom

Single
atom
cooling



Sodium

MOT



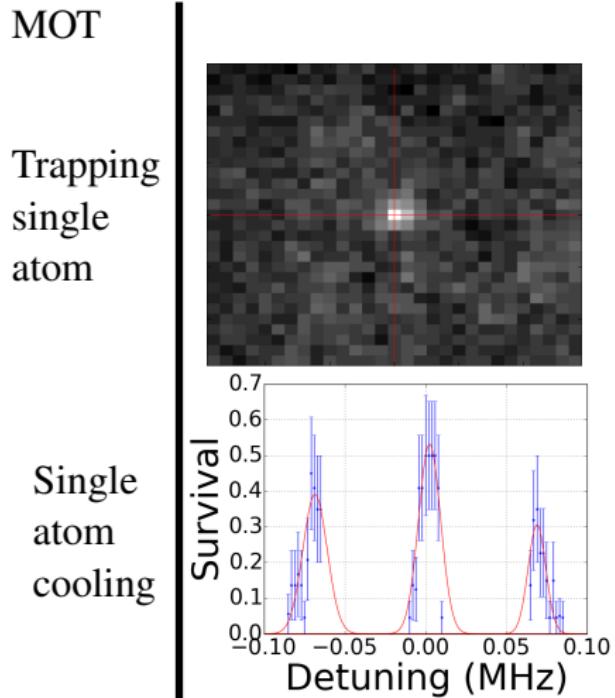
Looking
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Challenges

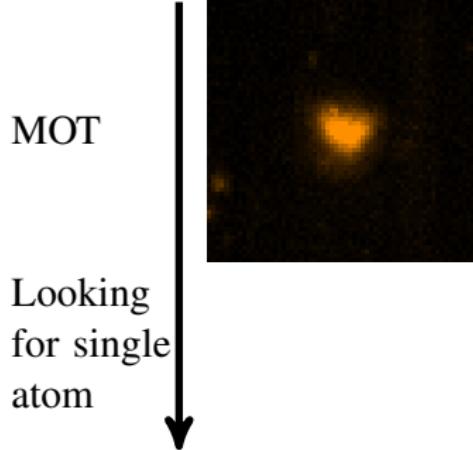
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Current state: Atom cooling

Cesium



Sodium



Challenges

- Sodium laser
- MOT stability

Laser system for Sodium

Sodium D lines $\approx 589\text{nm}$

- D2 line
Cooling and Imaging
- D1 line
Pumping and Cooling
- Off resonance
($\delta \approx 10\text{GHz}$)
Raman transition

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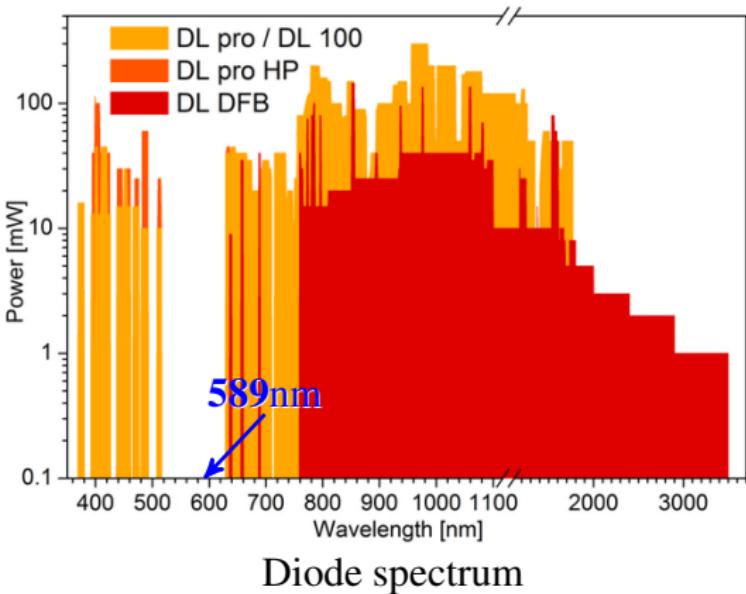
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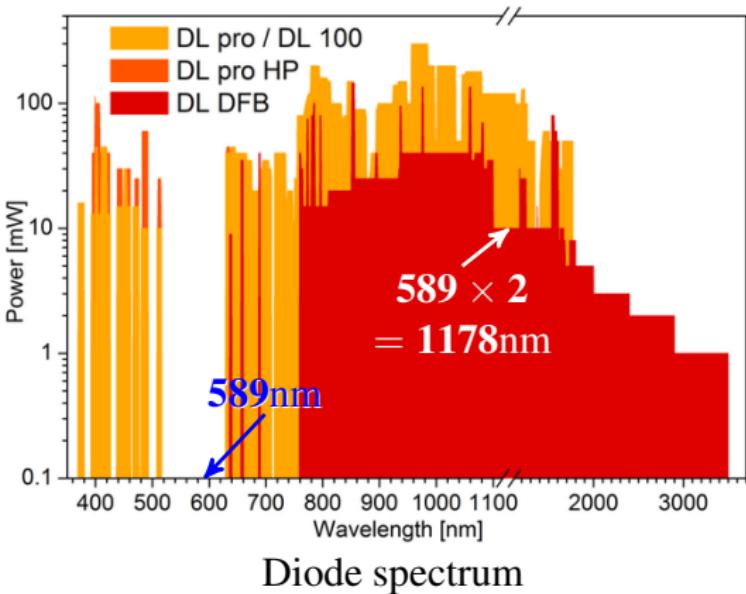


(Picture from Topica)

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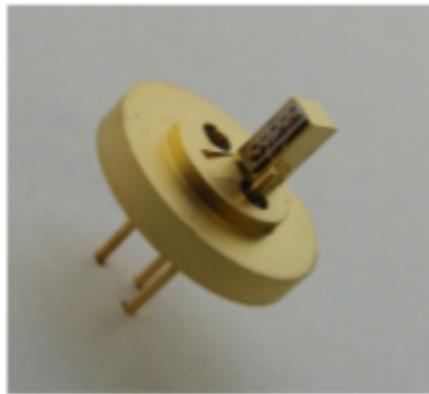


(Picture from Topica)

1178nm seed diode laser

Laser diode from Innolume

- Max power: 200mW (@ 500mA)
- Line width: < 200kHz
- Mode hop free: 3GHz
- Tunable over > 100nm: 1175-1280nm

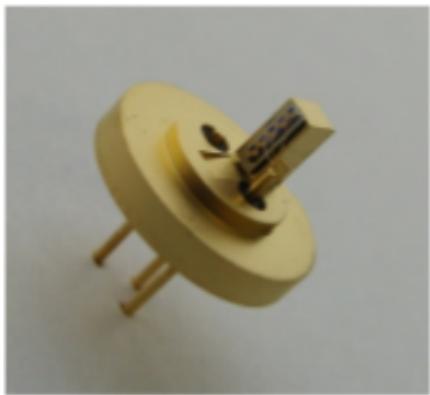


Picture from Innolume

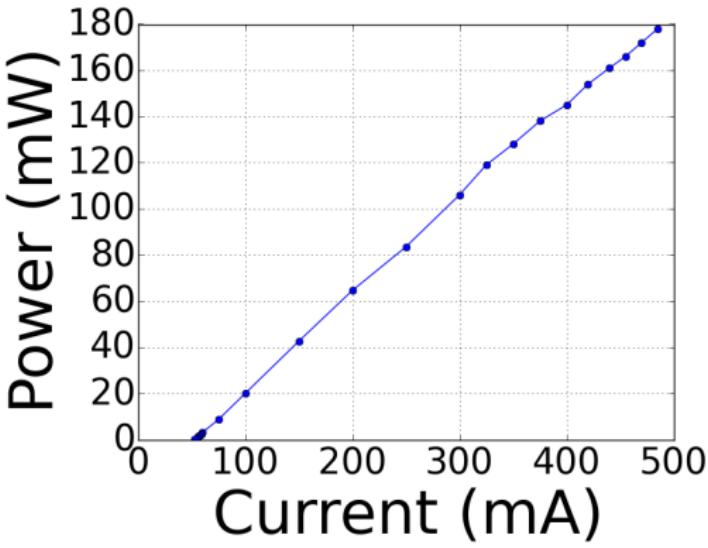
1178nm seed diode laser

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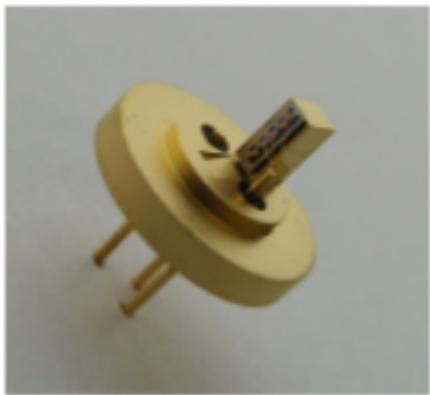
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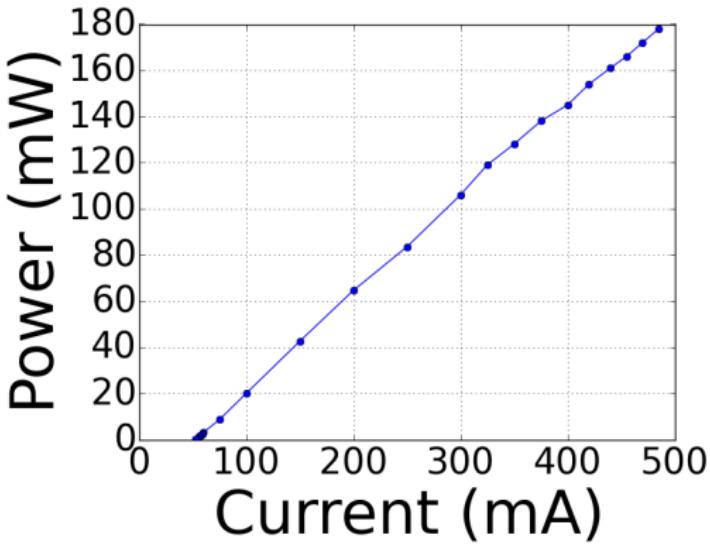
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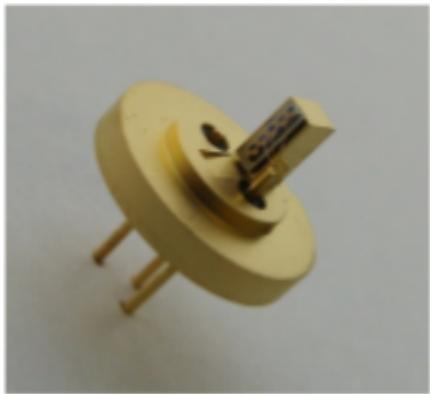
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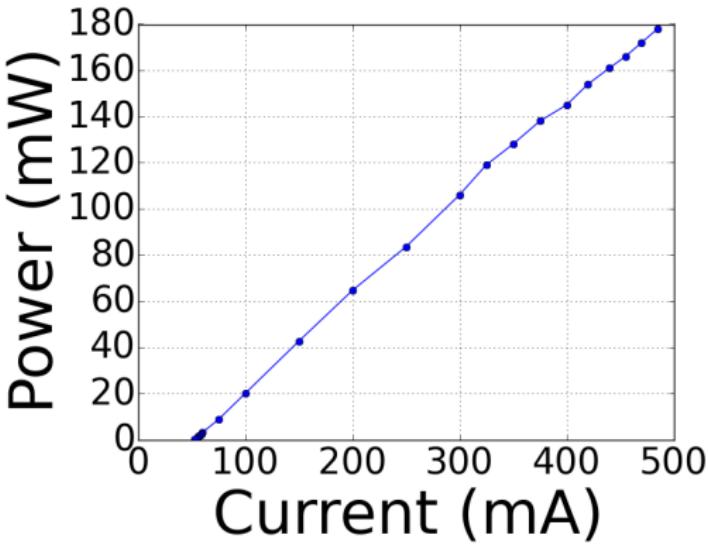
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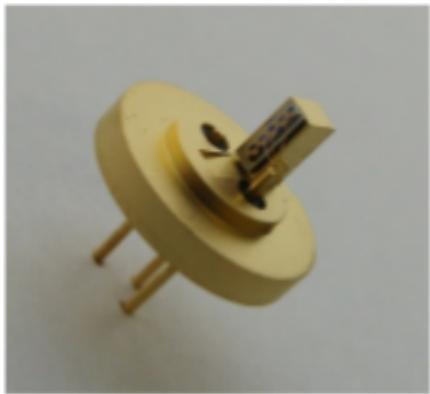
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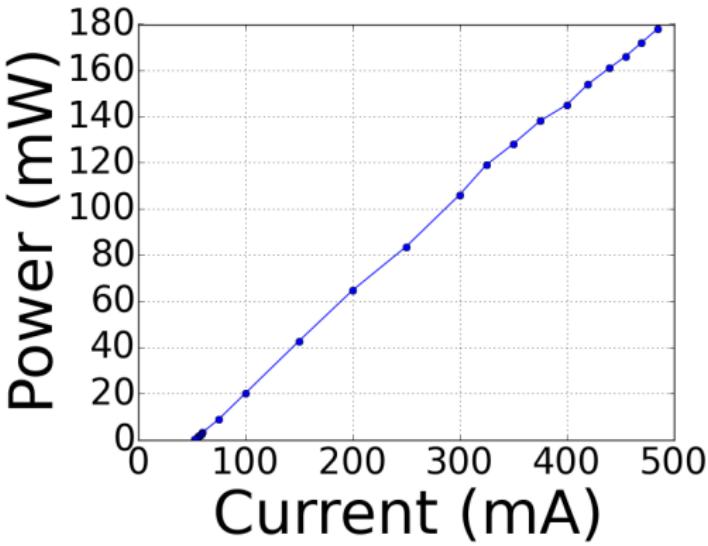
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Frequency doubling to 589nm

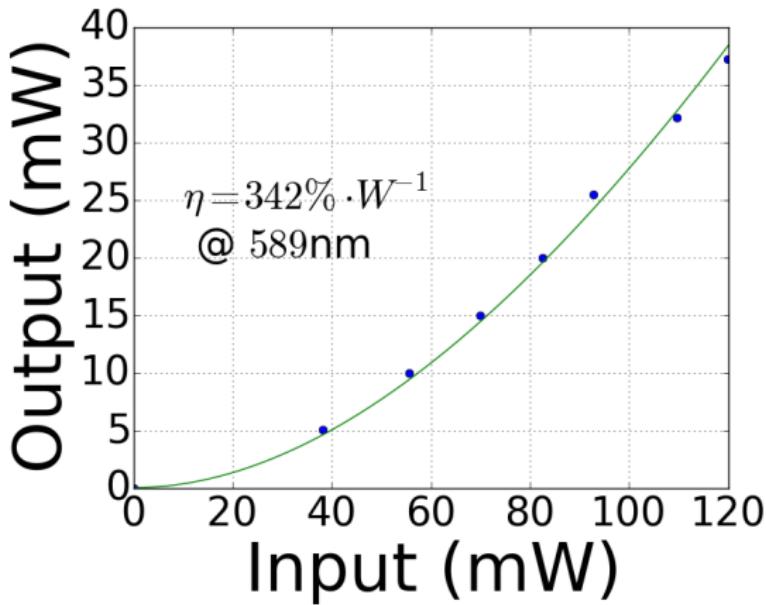


Waveguide doubler module
from NTT Electronics

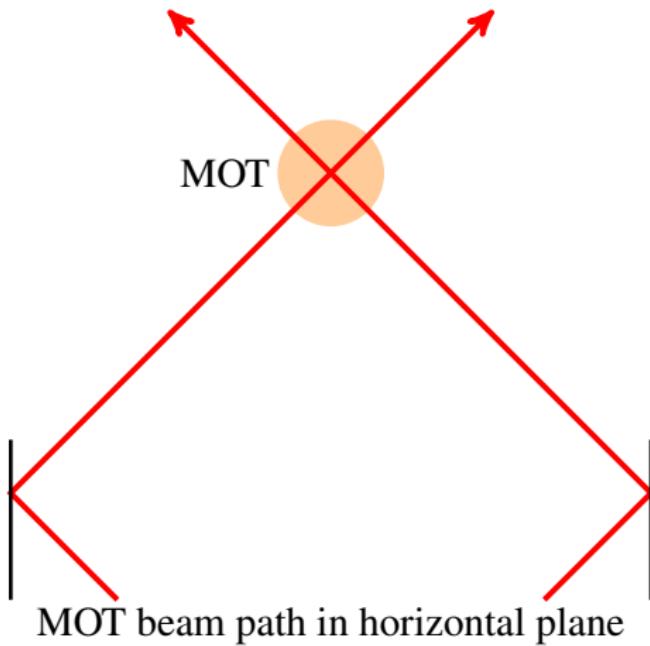
Frequency doubling to 589nm



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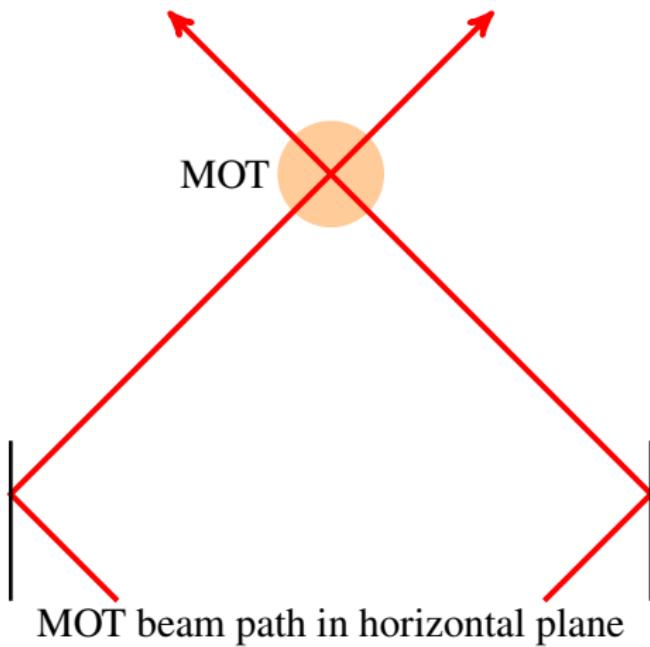


MOT stability



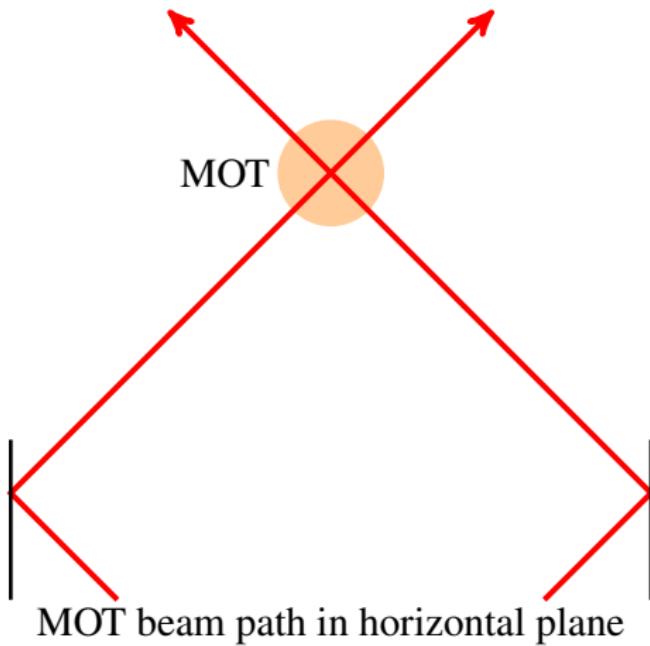
- Low vapor pressure
- Small Beam ($\phi \approx 1\text{cm}$)
- Small MOT ($\phi \approx 2\text{mm}$)

MOT stability



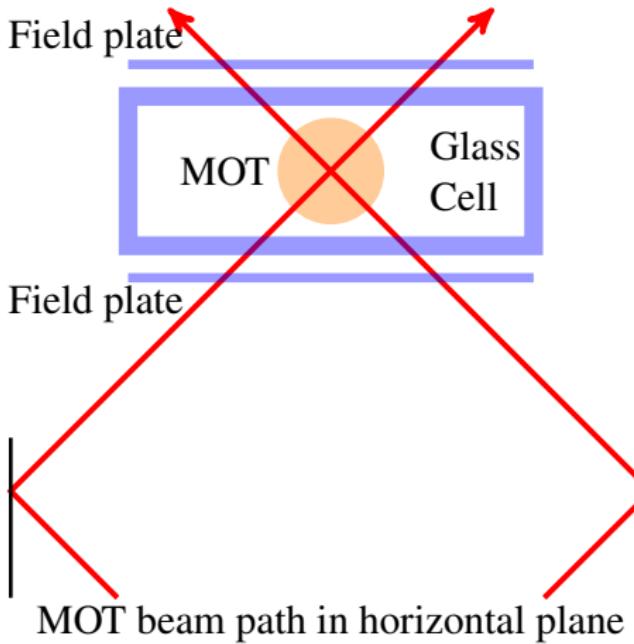
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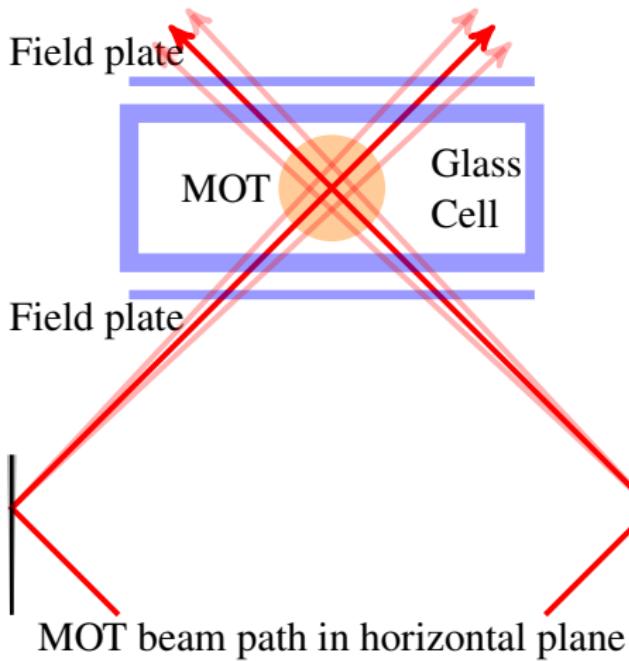
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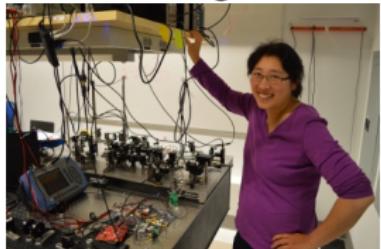
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MOT stability

Prof. Kang-Kuen



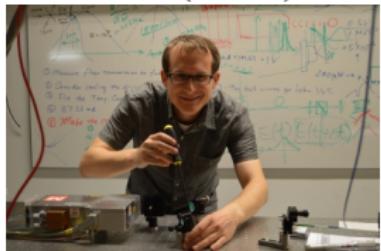
Yu (KRb)



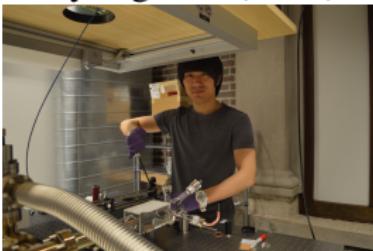
Saahil (Undergrad.)



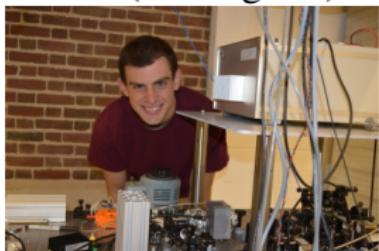
Nick (NaCs)



Hyungmok (KRb)



Will (Undergrad.)



Lee (NaCs)

