

High Resolution Action Spectrum of C₂H₂⁺

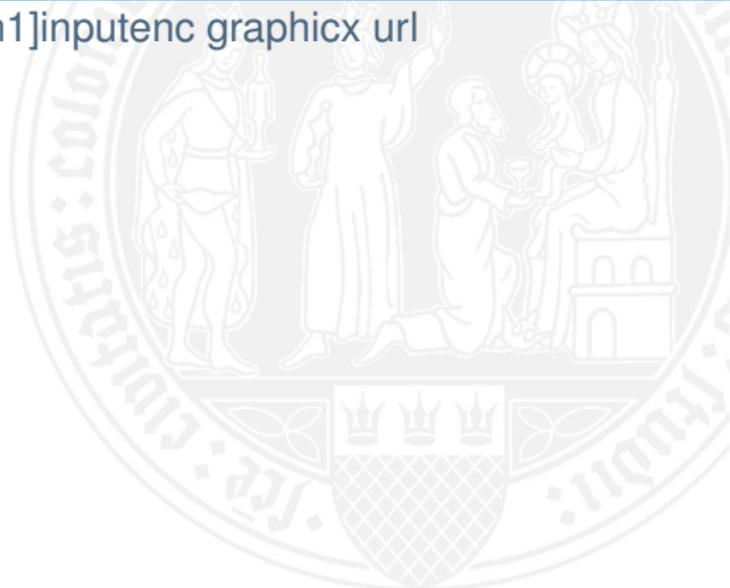
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Thomas Giesen Stephan Schlemmer

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June 20, 2011

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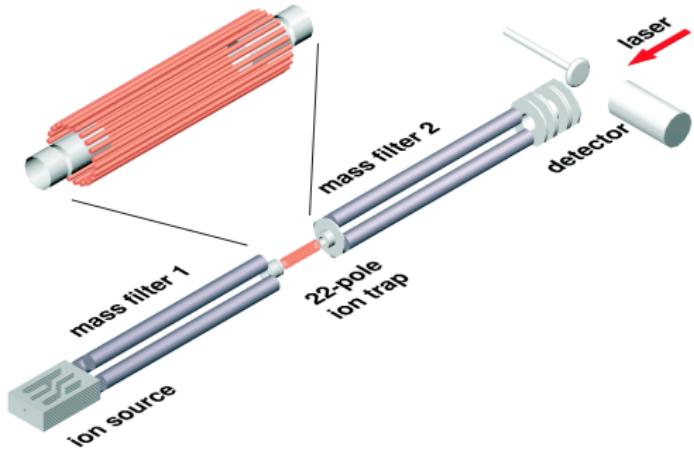
22-Pole Ion Trap



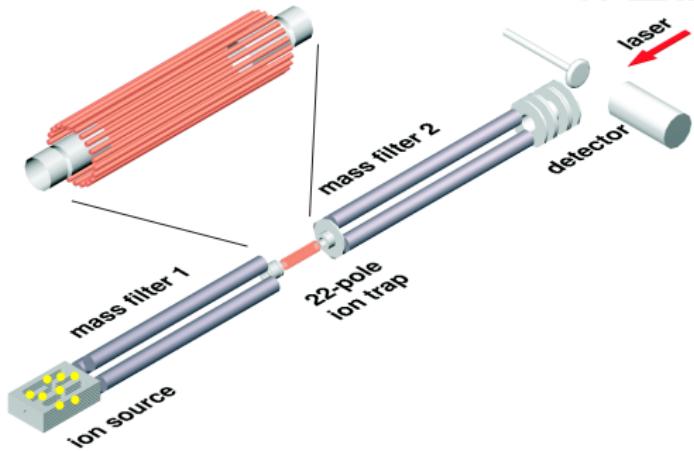
22-Pole Ion Trap



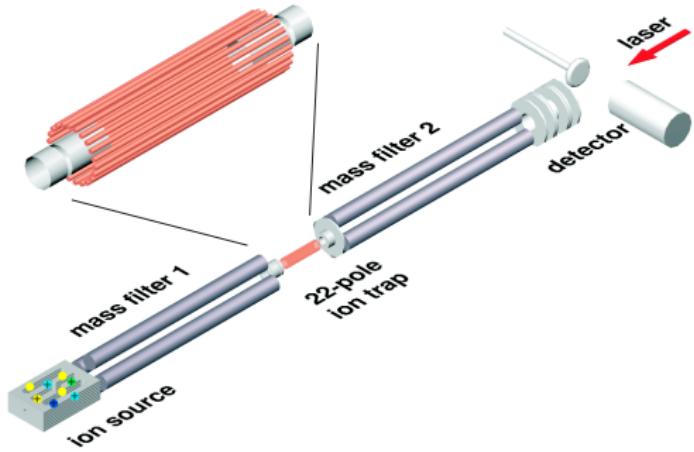
22-Pole Ion Trap



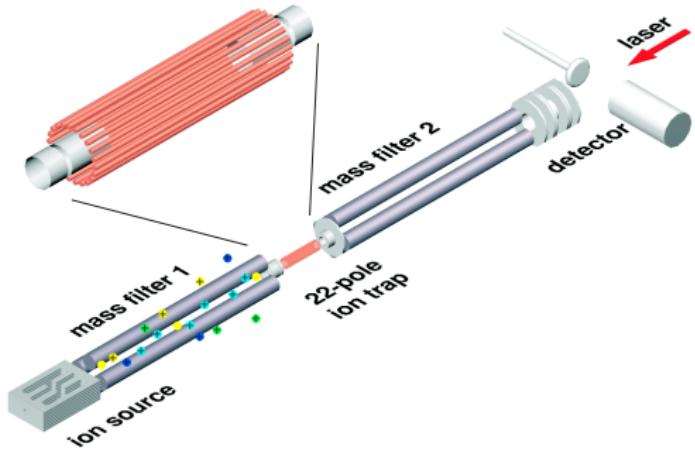
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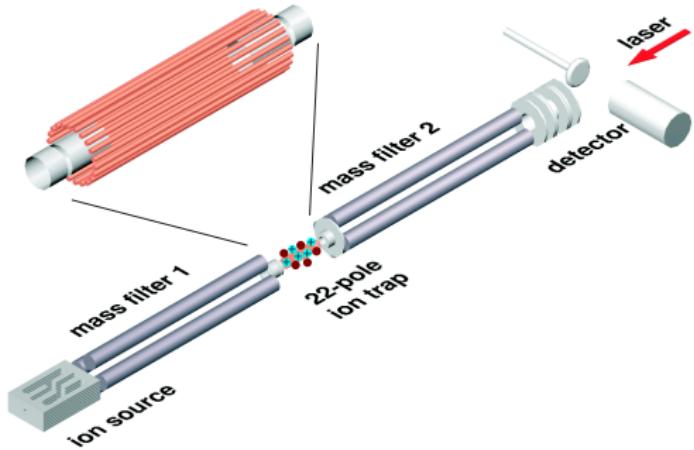
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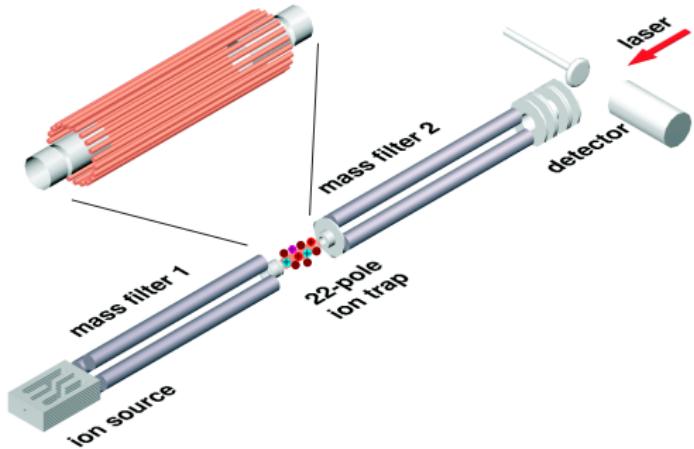
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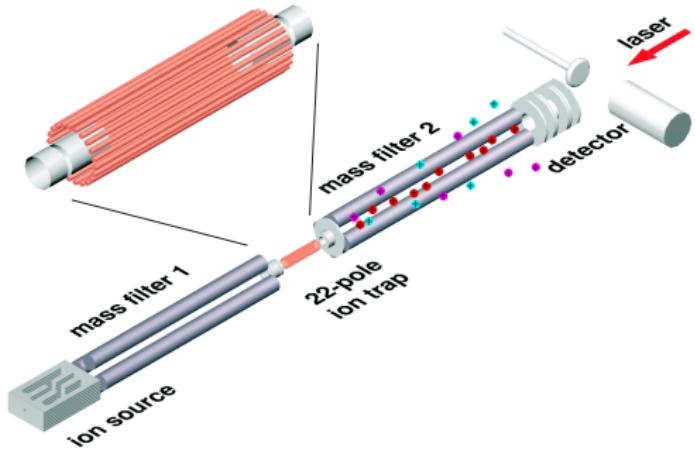
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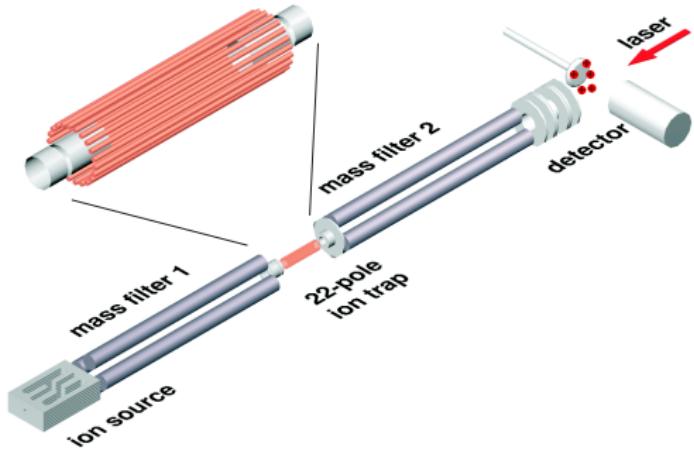
22-Pole Ion Trap



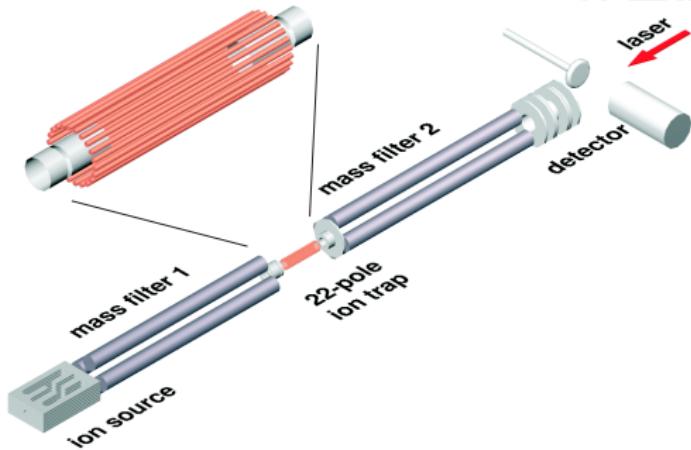
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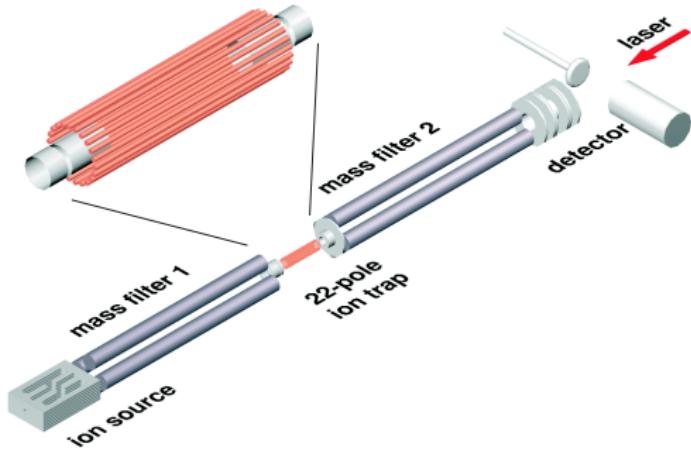


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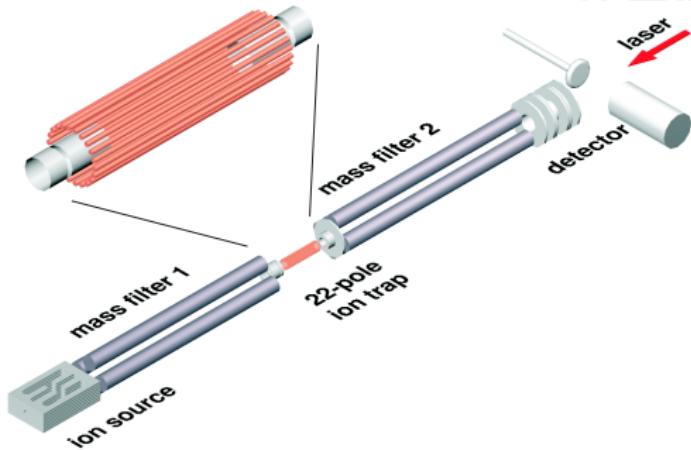
► Mass Selection

22-Pole Ion Trap



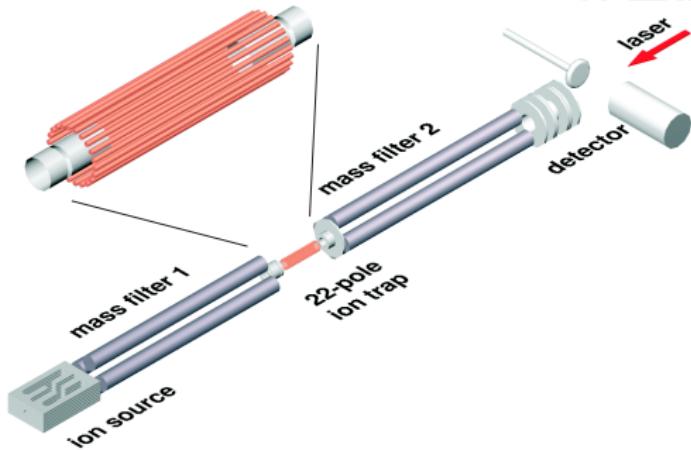
- ▶ Mass Selection
- ▶ Trap ≈ 1000 Ions

22-Pole Ion Trap



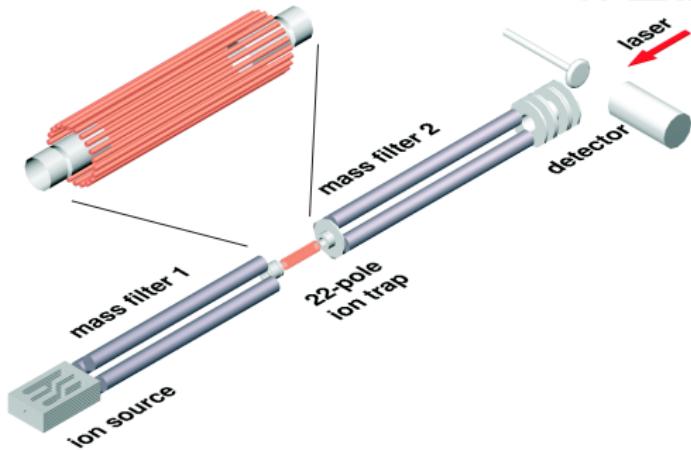
- ▶ Mass Selection
- ▶ Trap ≈ 1000 Ions
- ▶ Neutral Reaction Gas

22-Pole Ion Trap



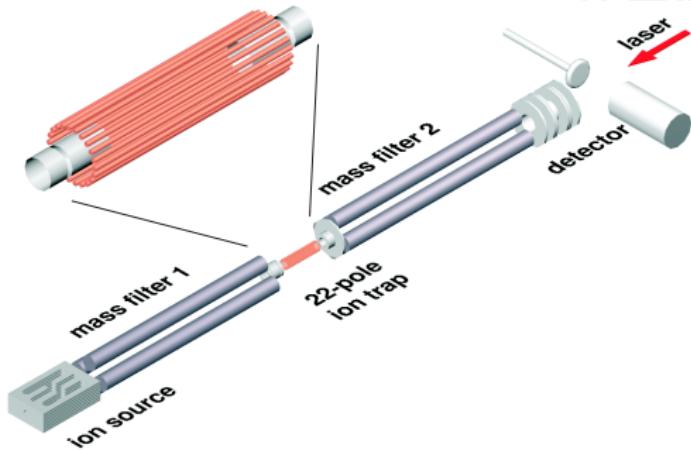
- ▶ Mass Selection
- ▶ Trap ≈ 1000 Ions
- ▶ Neutral Reaction Gas
- ▶ $T \approx 20$ K

22-Pole Ion Trap



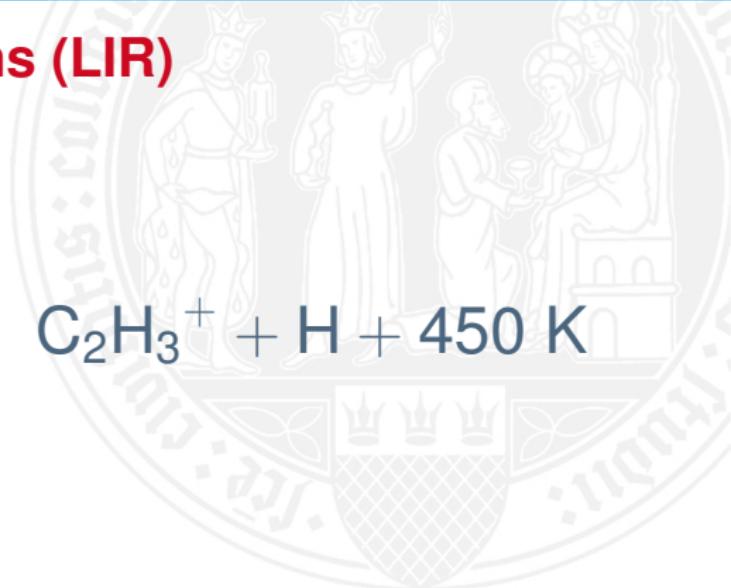
- ▶ Mass Selection
- ▶ Trap ≈ 1000 Ions
- ▶ Neutral Reaction Gas
- ▶ $T \approx 20$ K
- ▶ Different Radiation Sources

22-Pole Ion Trap

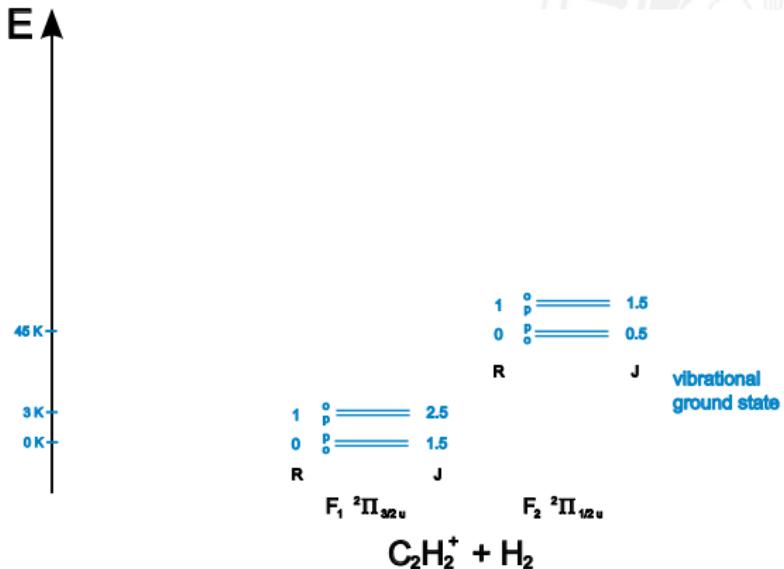


- ▶ Mass Selection
- ▶ Trap ≈ 1000 Ions
- ▶ Neutral Reaction Gas
- ▶ $T \approx 20$ K
- ▶ Different Radiation Sources
- ▶ Use Endothermic Reaction for Spectroscopy

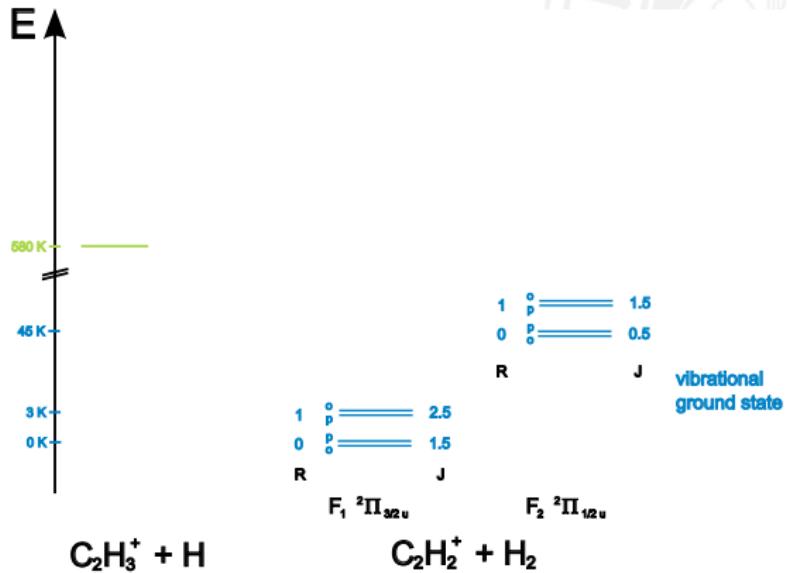
Laser Induced Reactions (LIR)



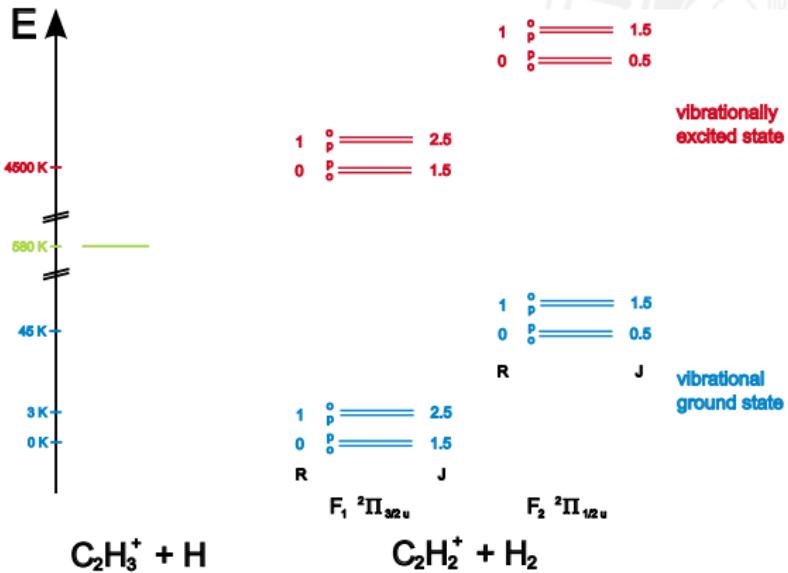
Laser Induced Reactions (LIR)



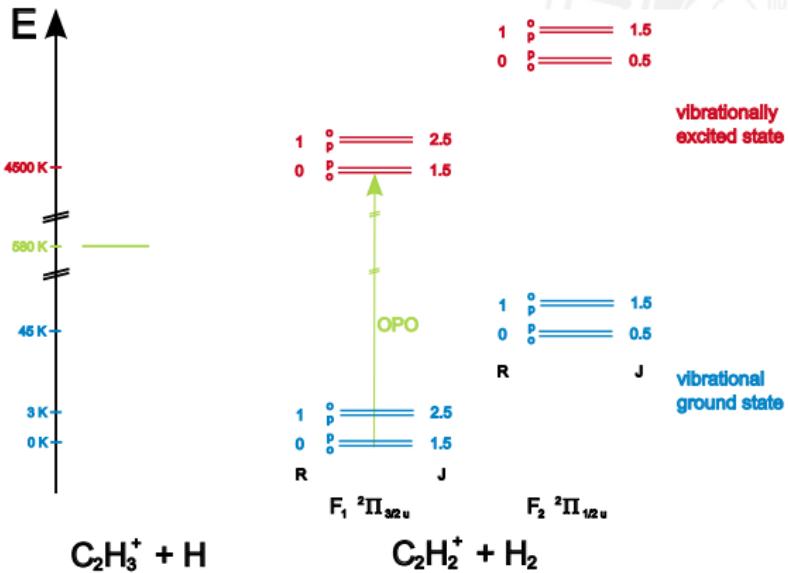
Laser Induced Reactions (LIR)



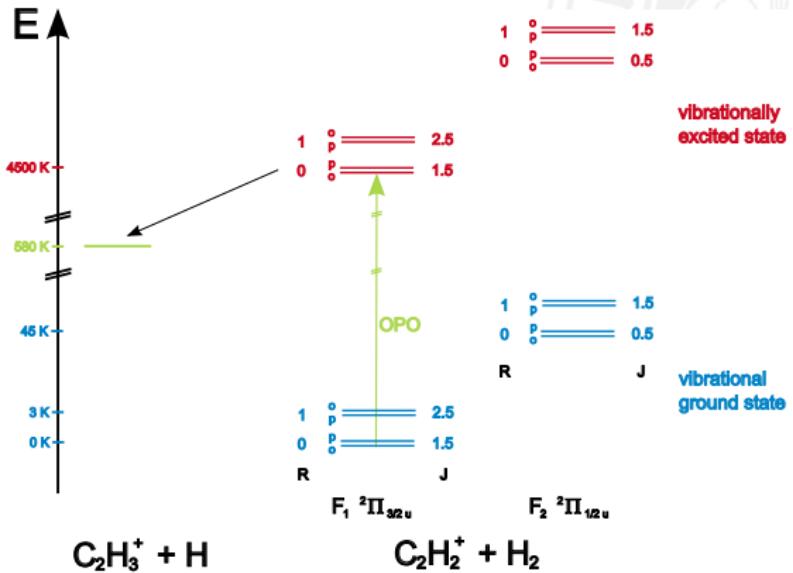
Laser Induced Reactions (LIR)



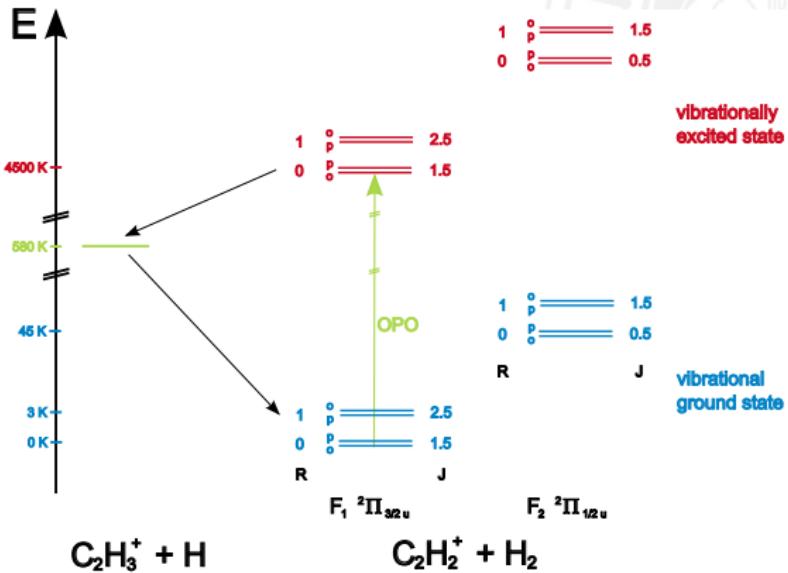
Laser Induced Reactions (LIR)



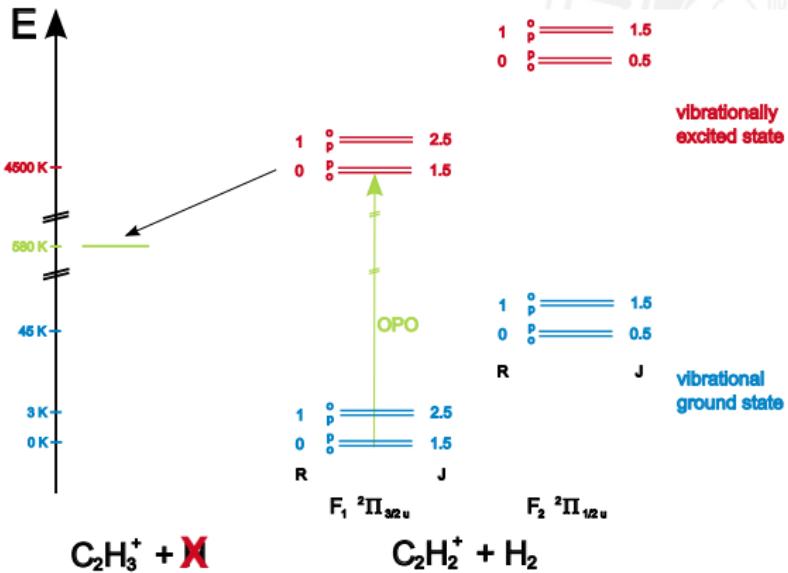
Laser Induced Reactions (LIR)



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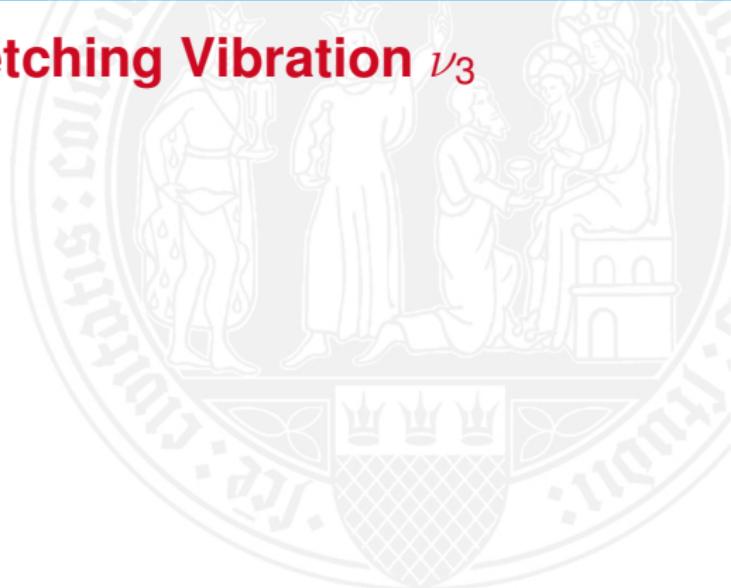


Laser Induced Reactions (LIR)

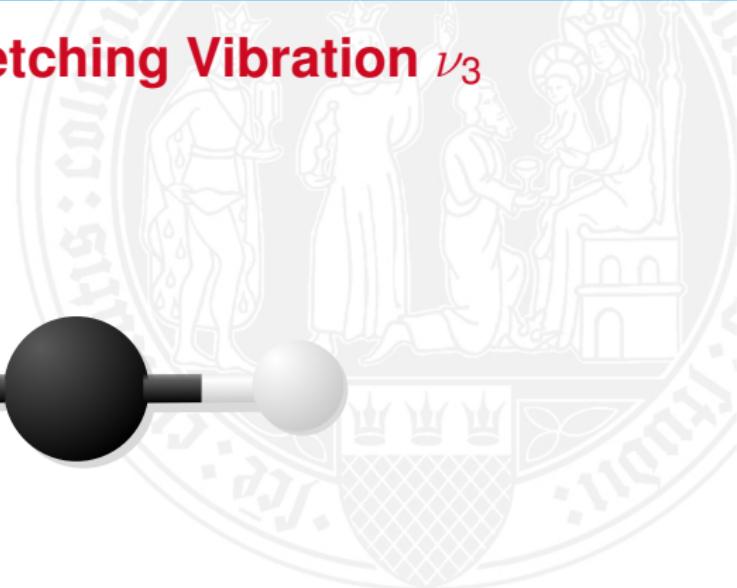
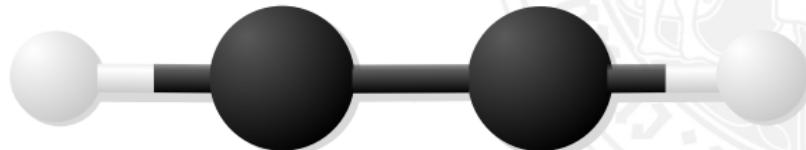


C_2H_2^+

Antisymmetric C-H Stretching Vibration ν_3



Antisymmetric C-H Stretching Vibration ν_3



Antisymmetric C-H Stretching Vibration ν_3



Antisymmetric C-H Stretching Vibration ν_3

${}^2\Pi$ state

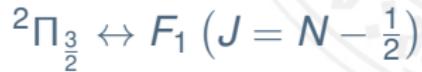
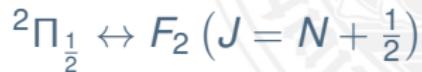
Hamiltonian²:

$$\begin{aligned} H = & BN^2 - DN^4 + HN^6 \\ & + \frac{1}{2} \left[\left(A + A_D N^2 \right), L_Z S_Z \right]_+ \\ & + \frac{1}{2} p \left(\Lambda_+^2 S_- N_- + \Lambda_-^2 S_+ N_+ \right) \\ & - \frac{1}{2} q \left(\Lambda_+^2 N_-^2 + \Lambda_-^2 N_+^2 \right) \end{aligned}$$

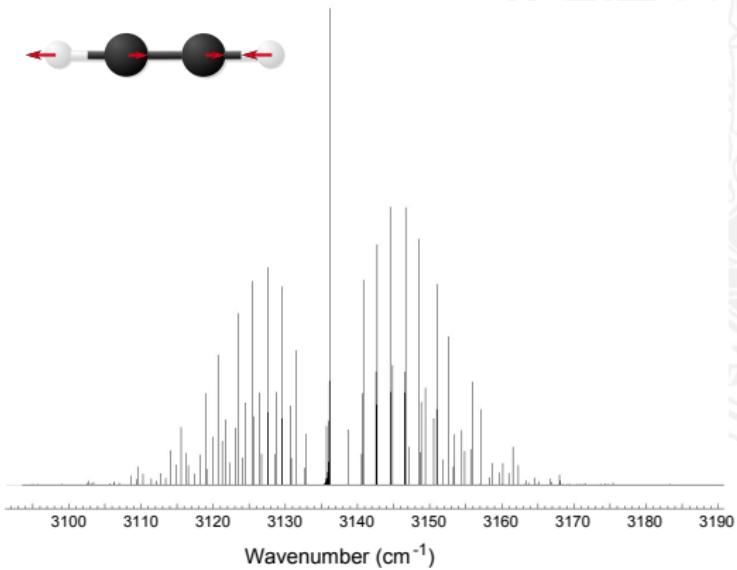
²Jagod et al, J. Chem. Phys, 1992

Antisymmetric C-H Stretching Vibration ν_3

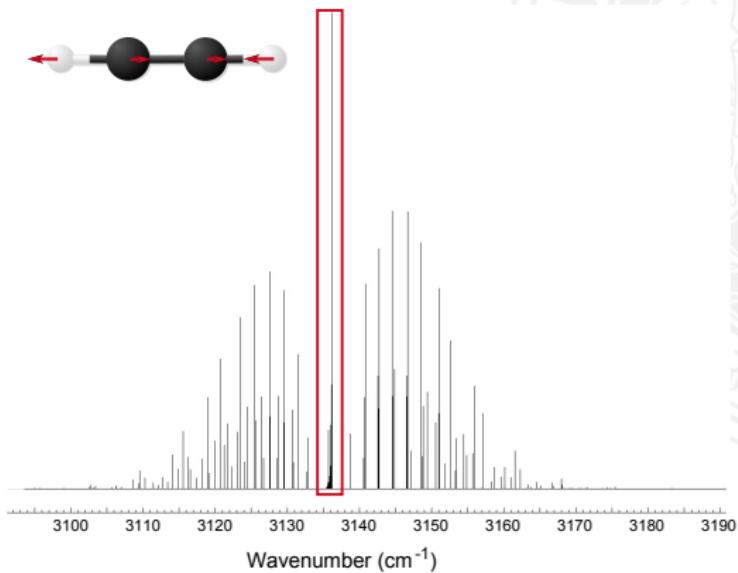
Low values of J : Hund's case a, higher values of J : Hund's case b



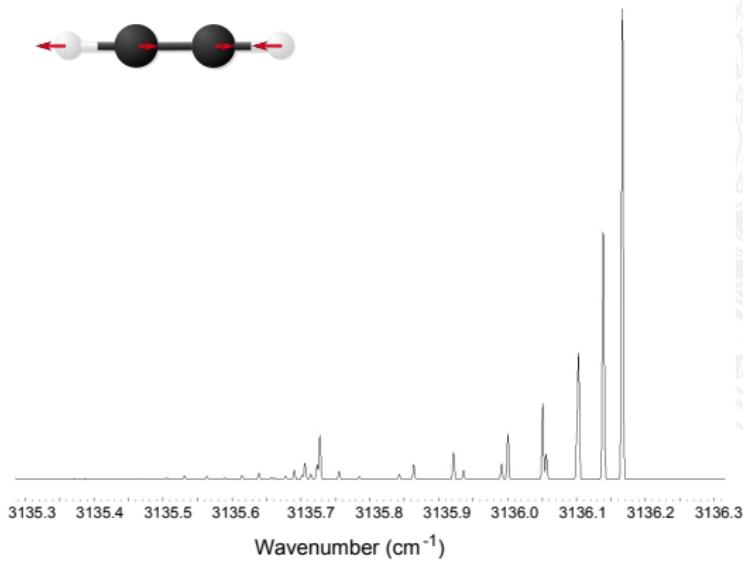
Antisymmetric C-H Stretching Vibration ν_3



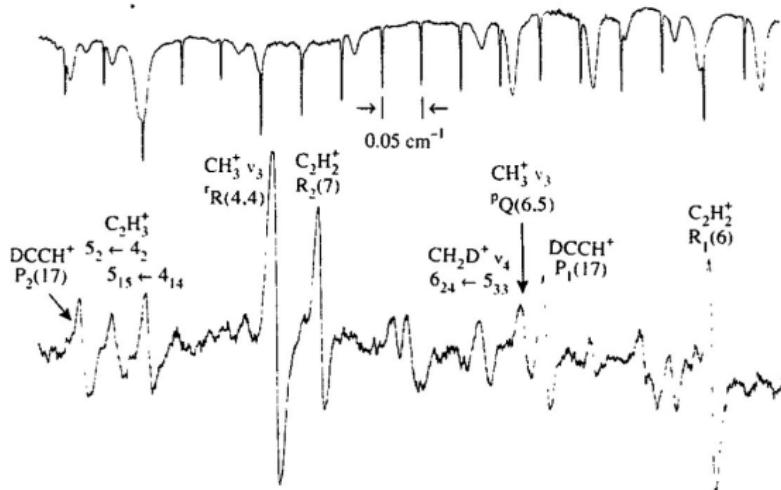
Antisymmetric C-H Stretching Vibration ν_3



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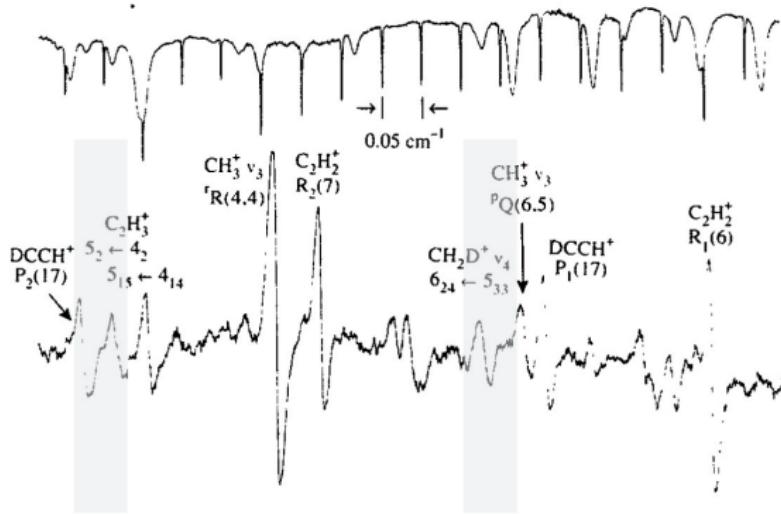


Discharge Tube



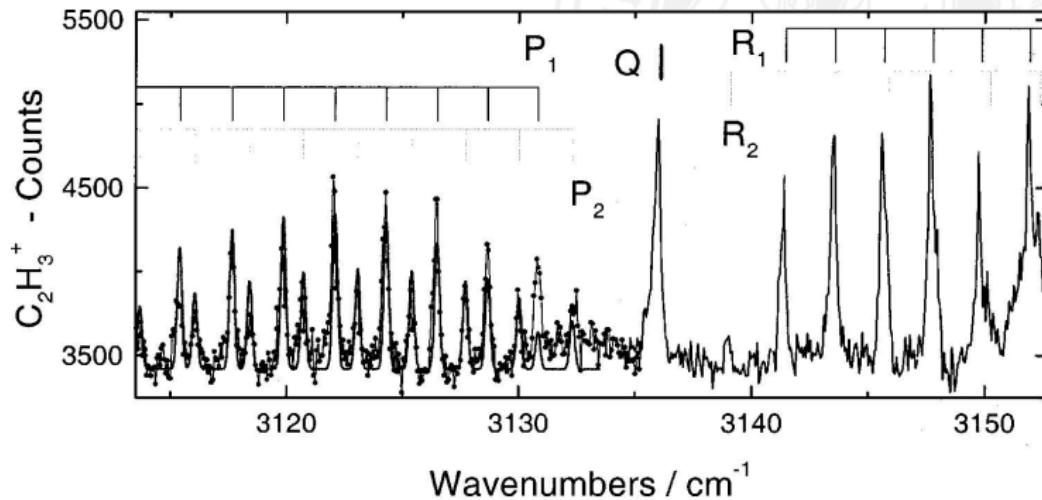
Jagod et al, J. Chem. Phys, 1992

Discharge Tube



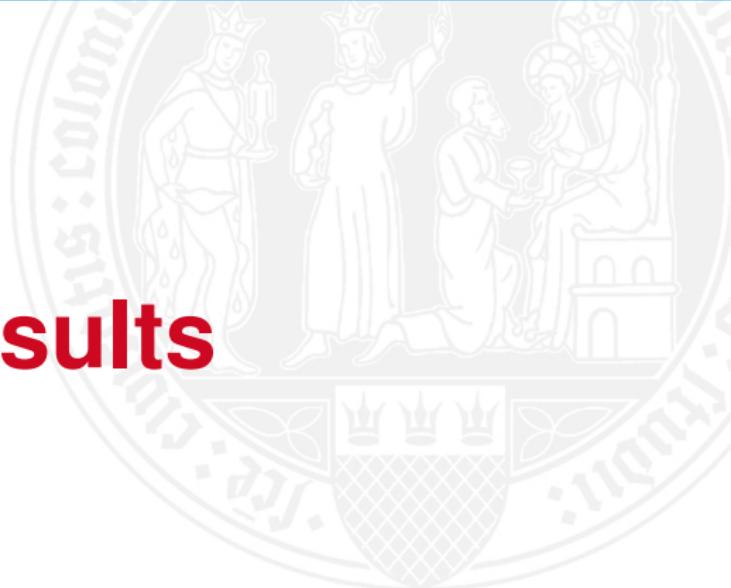
Jagod et al, J. Chem. Phys, 1992

LIRTrap and Pulsed Laser

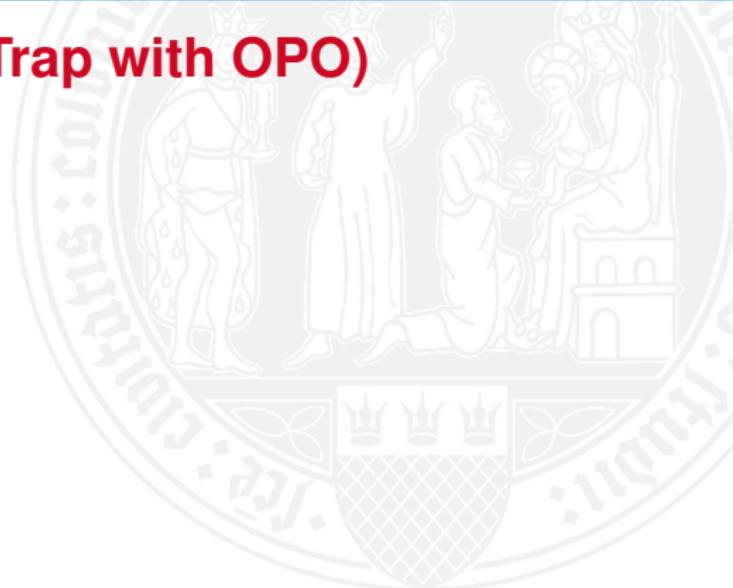


Schlemmer et al, J. Chem. Phys, 2002

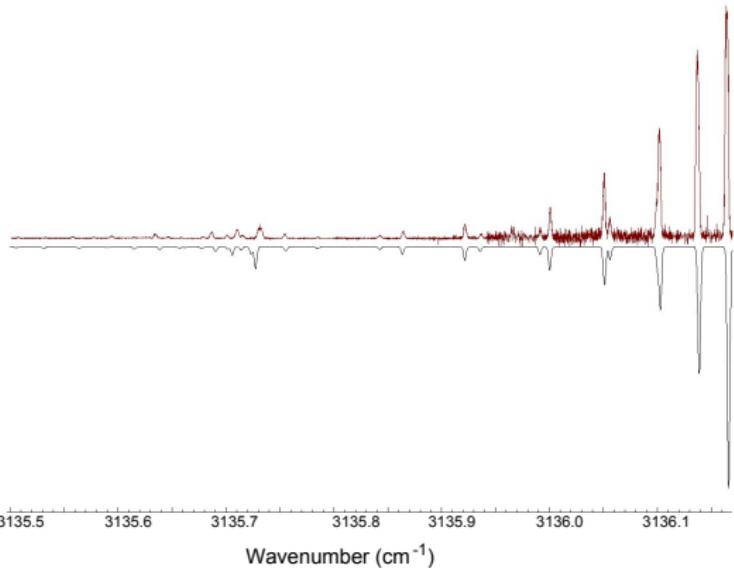
Results



Observed Spectra (LIRTrap with OPO)

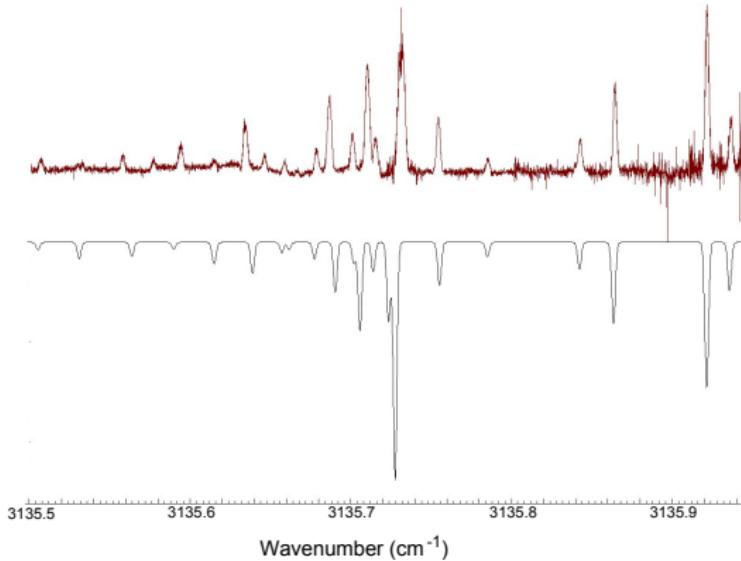


Observed Spectra (LIRTrap with OPO)



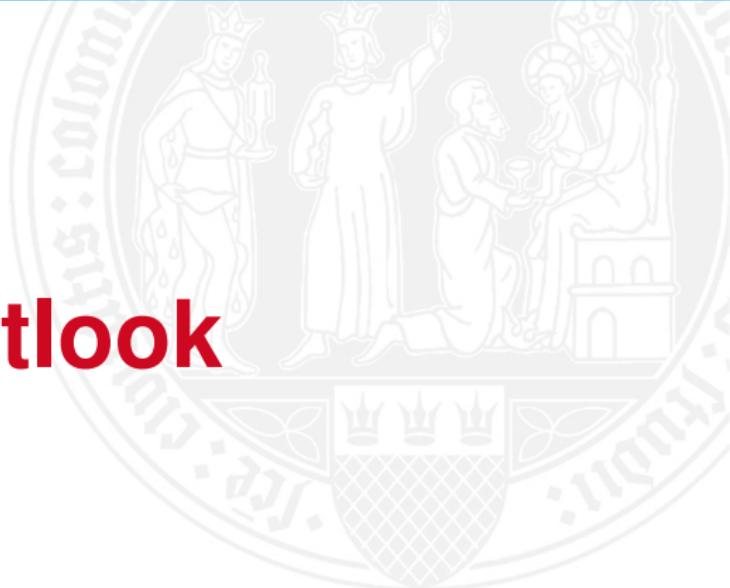
PGOPHER, a Program for Simulating Rotational Structure, C. M. Western, University of Bristol,

Observed Spectra (LIRTrap with OPO)

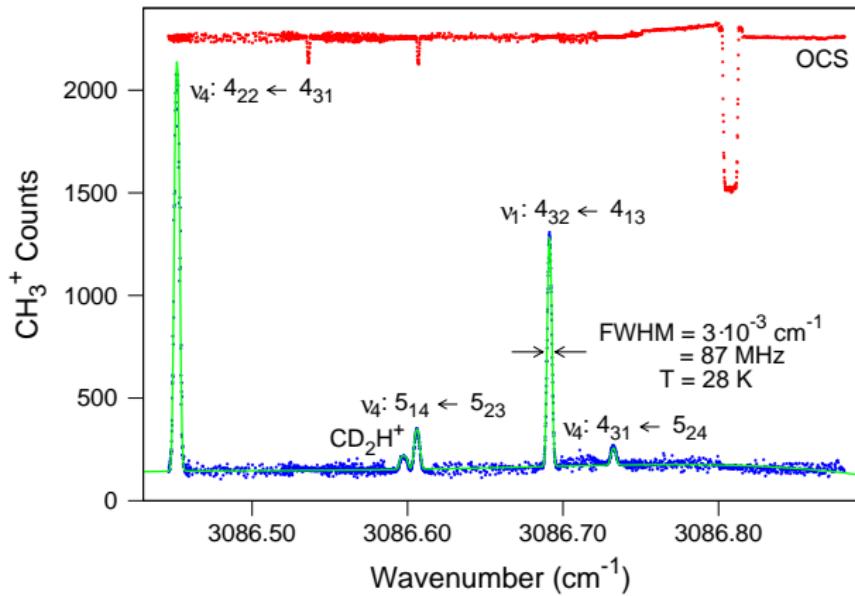


PGOPHER, a Program for Simulating Rotational Structure, C. M. Western, University of Bristol,

Outlook



Set up Reference Cell



Acknowledgements



Prof. Dr. Stephan
Schlemmer



Dr. Oskar Asvany



Jürgen Krieg



Prof. apl. Dr.
Thomas Giesen



Laboratory Astrophysics Group
University of Cologne



Bonn Cologne Graduate
School of Physics and
Astronomy

**Thank you for your
attention**

