



Hot Jupiters in the belly of SMAUG

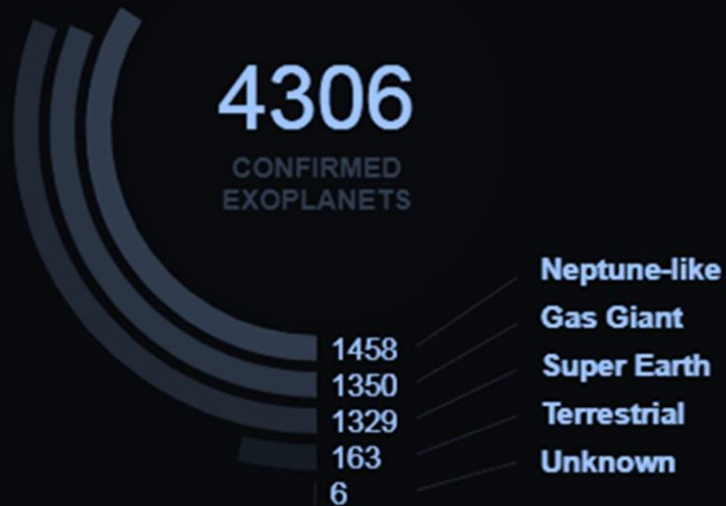
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DUDÁS Eszter



Exoplanet:

- planet beyond our solar system
- 100 billions
- up to date:



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Gas Giant – “Hot Jupiters”

- Hot: orbiting close to their star
thousands of degrees
- Jupiters: gas giant planets

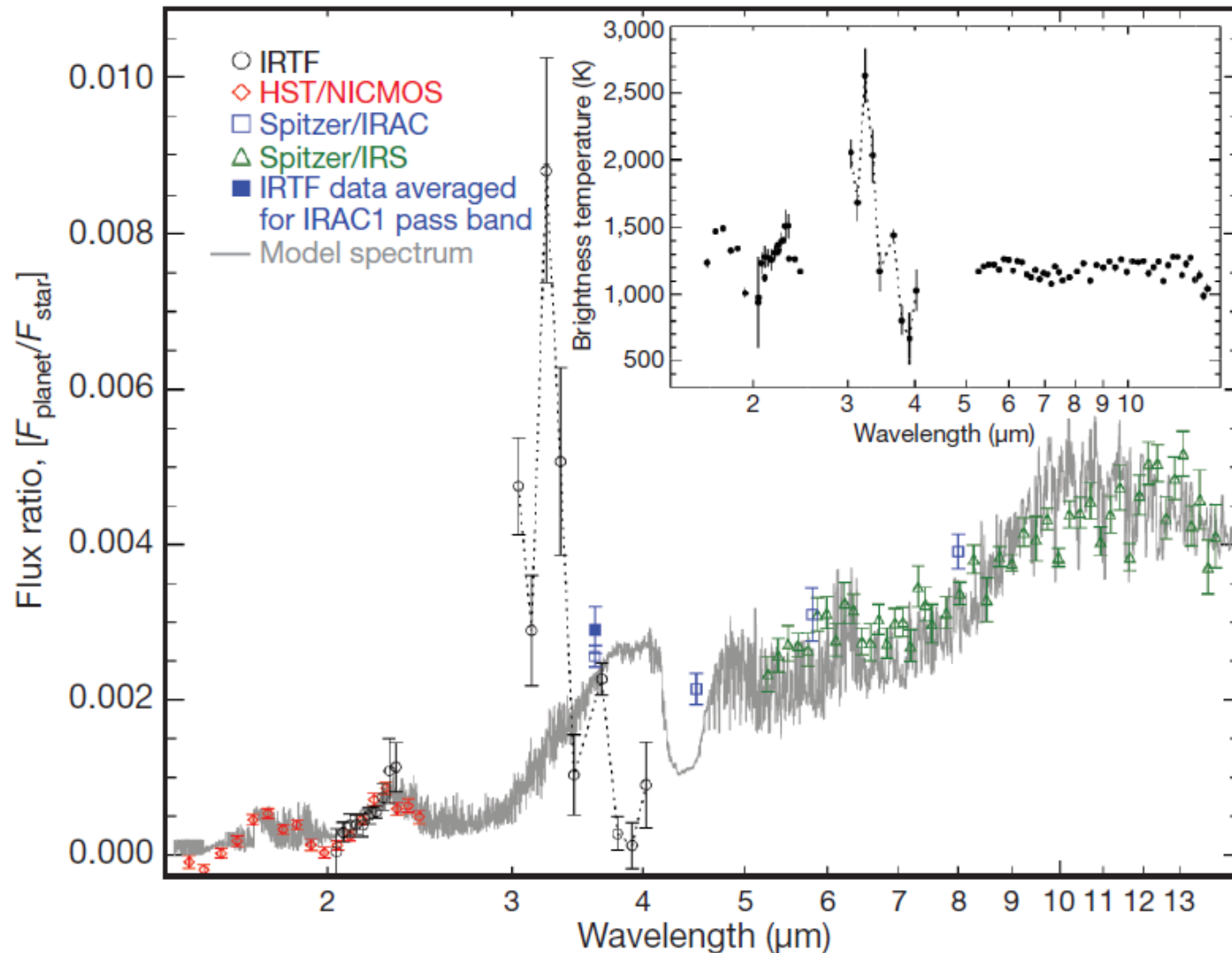


Searching for shadows

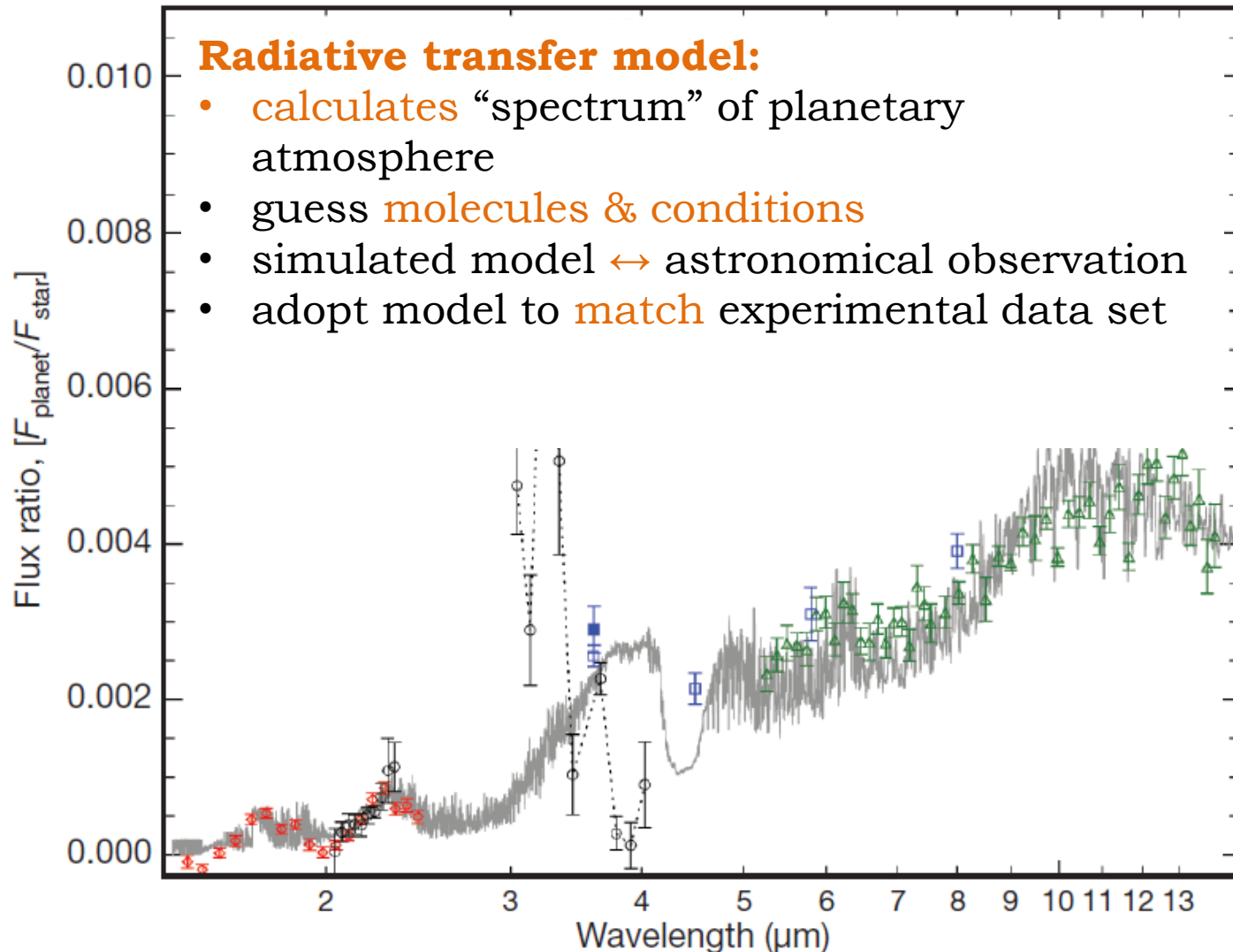
- several light-year away from us
- Space telescope: Hubble, Spitzer and Kepler/K2
- “Take photo” of the solar eclipse
- orbiting time: from 18 hours!!! → frequently new data



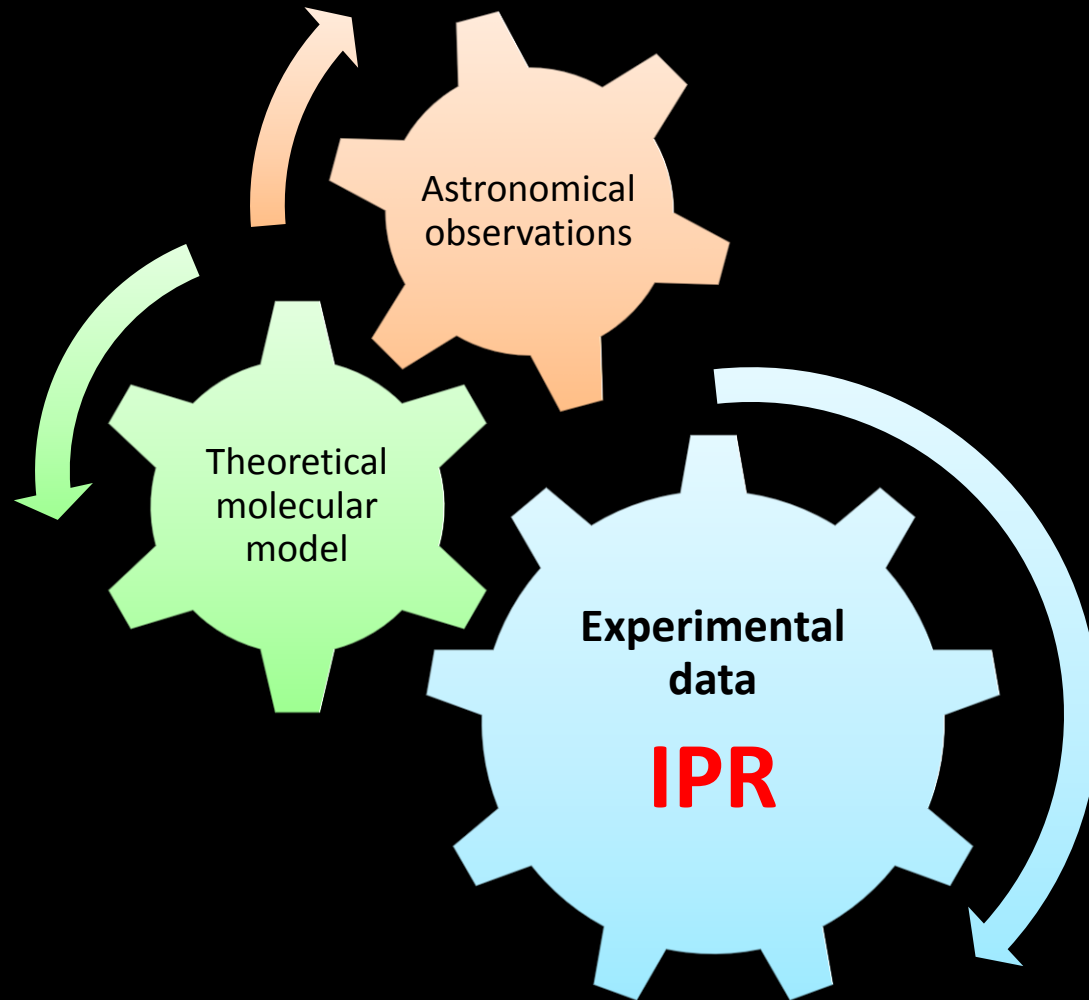
A radiative transfer model from the atmosphere of Hot Jupiter: HD189733b



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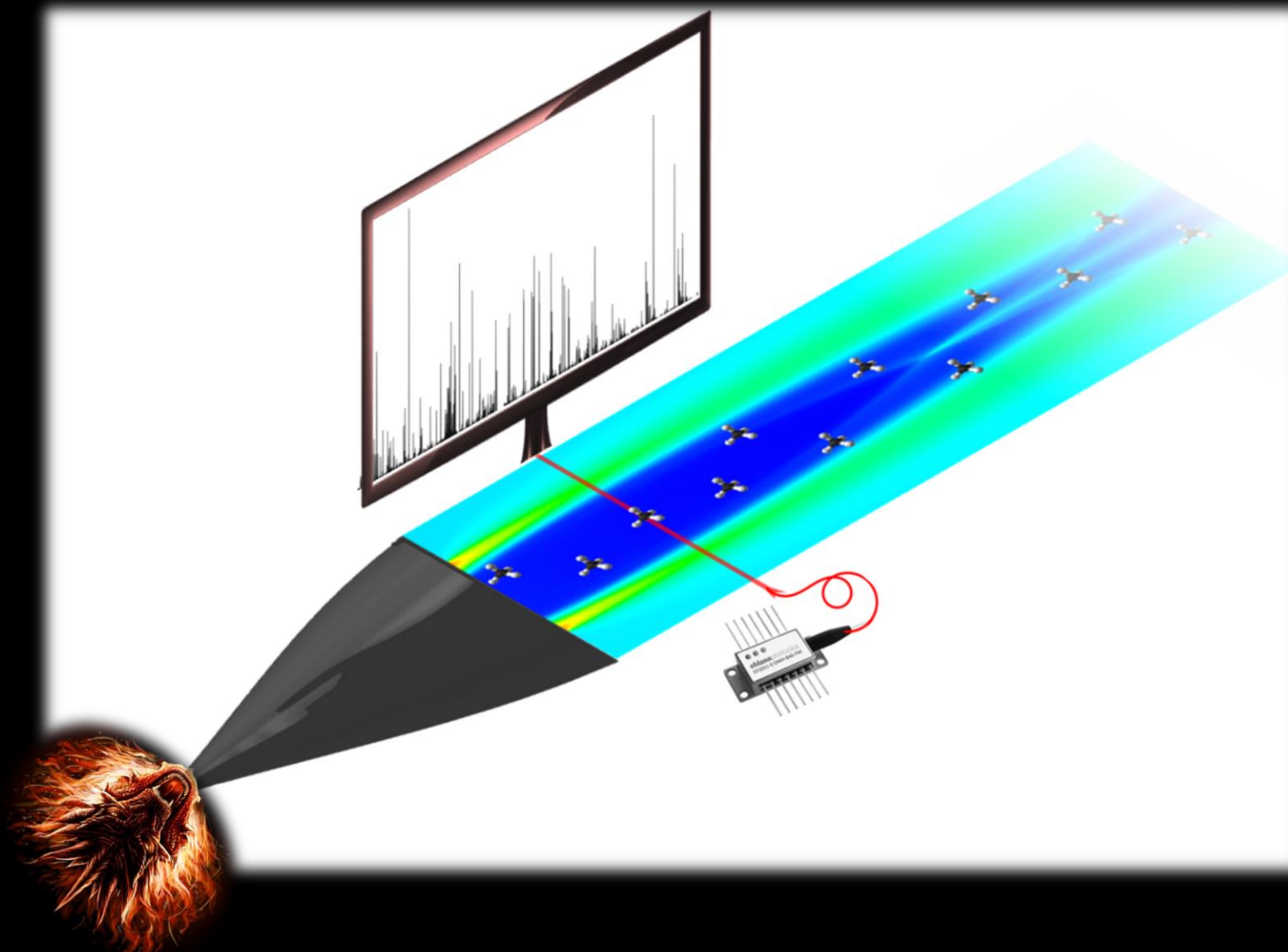


How to build a radiative transfer model?



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Spectroscopy of Molecules Accelerated in Uniform Gas flows





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Spectroscopy of Molecules Accelerated in Uniform Gas flows

Objective: record high temperature spectral data

- * Small hydrocarbons
- * in controlled conditions

Challenges: hot temperature spectra

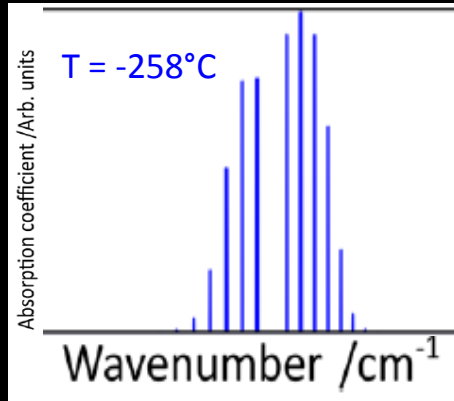
- * create the environment: +1800°C
- * overcrowded spectra for polyatomic molecules
- * line-by-line analysis very difficult

Our approach:

- * **non-LTE:** Decoupling internal degrees of freedom ($T_{\text{rot}} \ll T_{\text{vib}}$)
- * **LTE:** shockwave ($T_{\text{rot}} = T_{\text{vib}} = T_{\text{trans}}$)

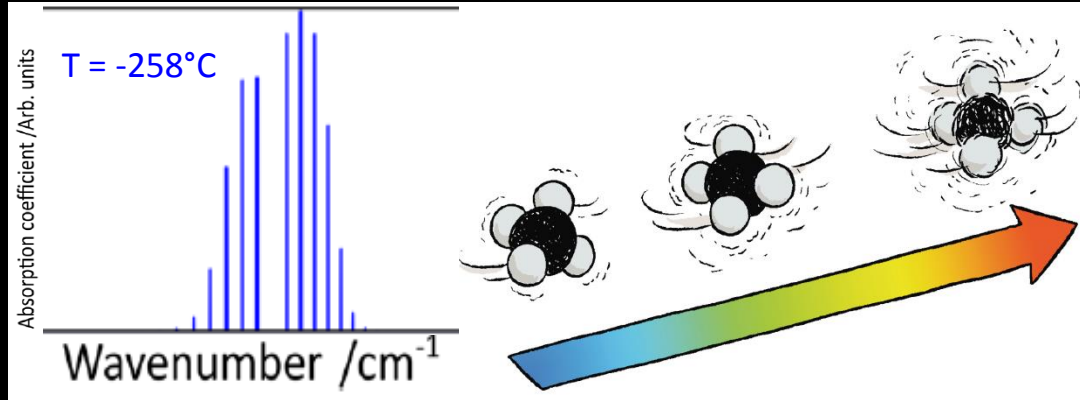
**The dance of a molecule:
ROTATION + VIBRATION**

The dance of a molecule: ROTATION + VIBRATION



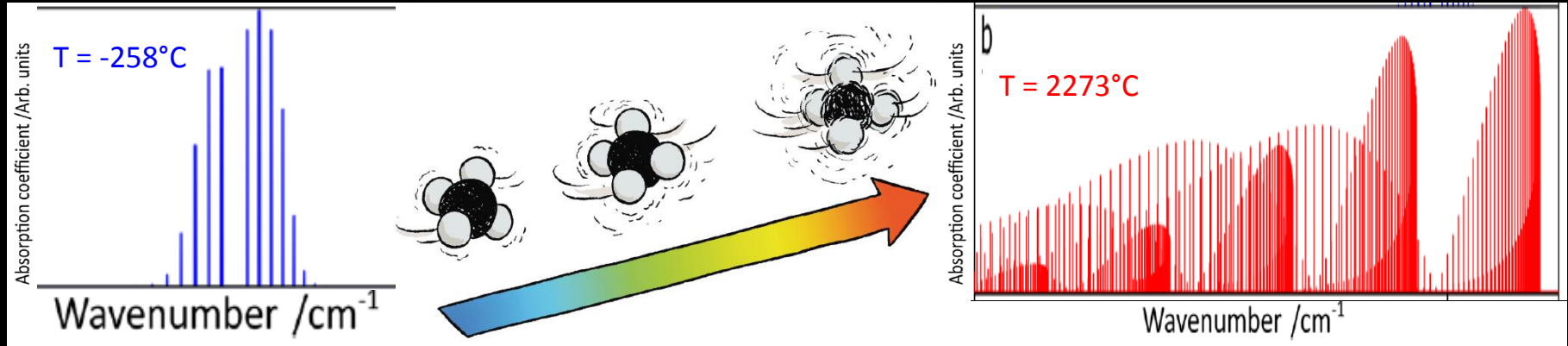
Every R+V combination has a unique energy → corresponding spectral line

The dance of a molecule: ROTATION + VIBRATION



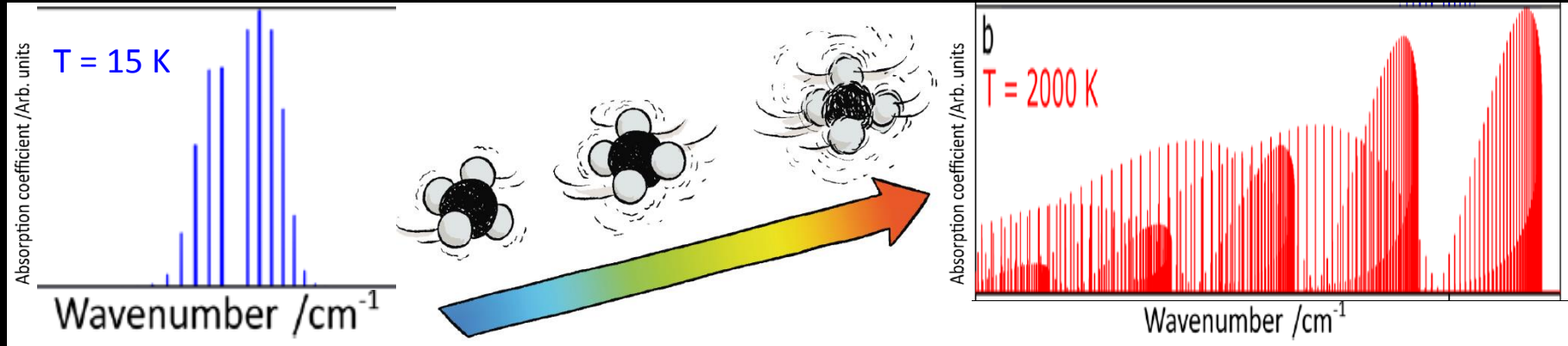
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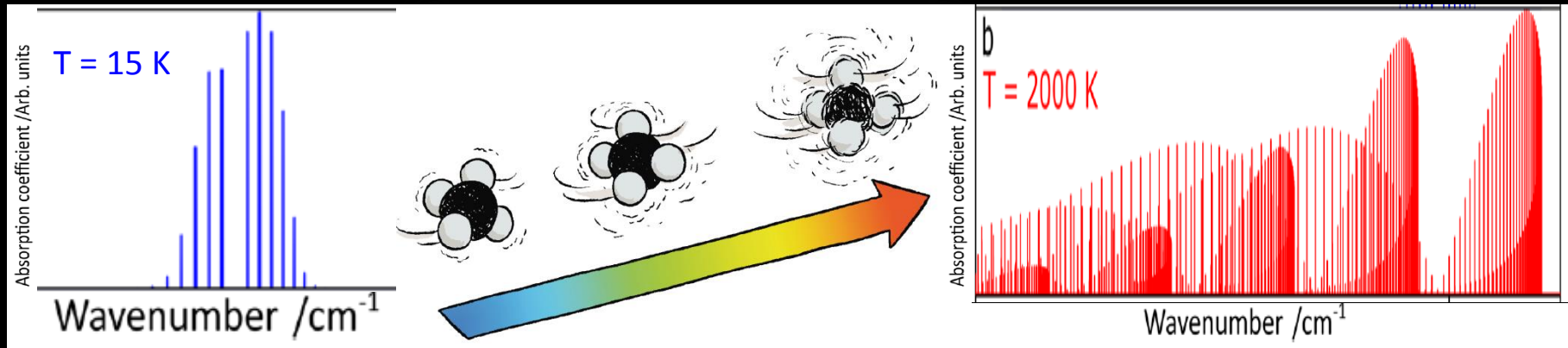


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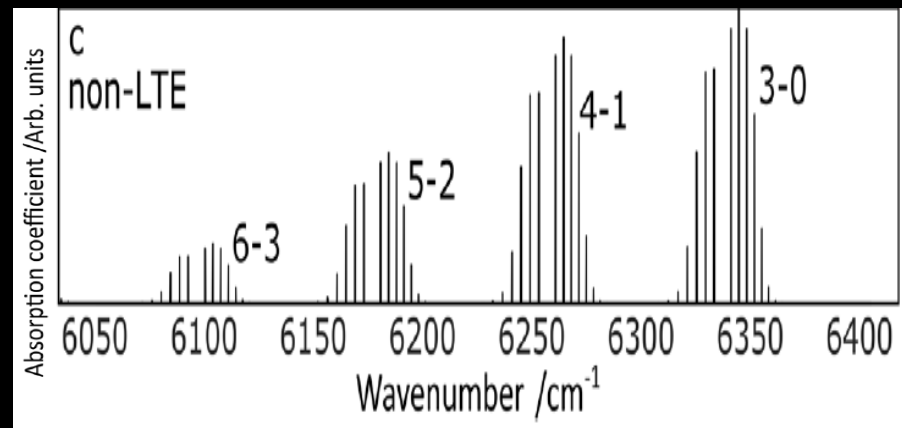
de Laval nozzle to create
hypersonic expansion

The dance of a molecule: ROTATION + VIBRATION

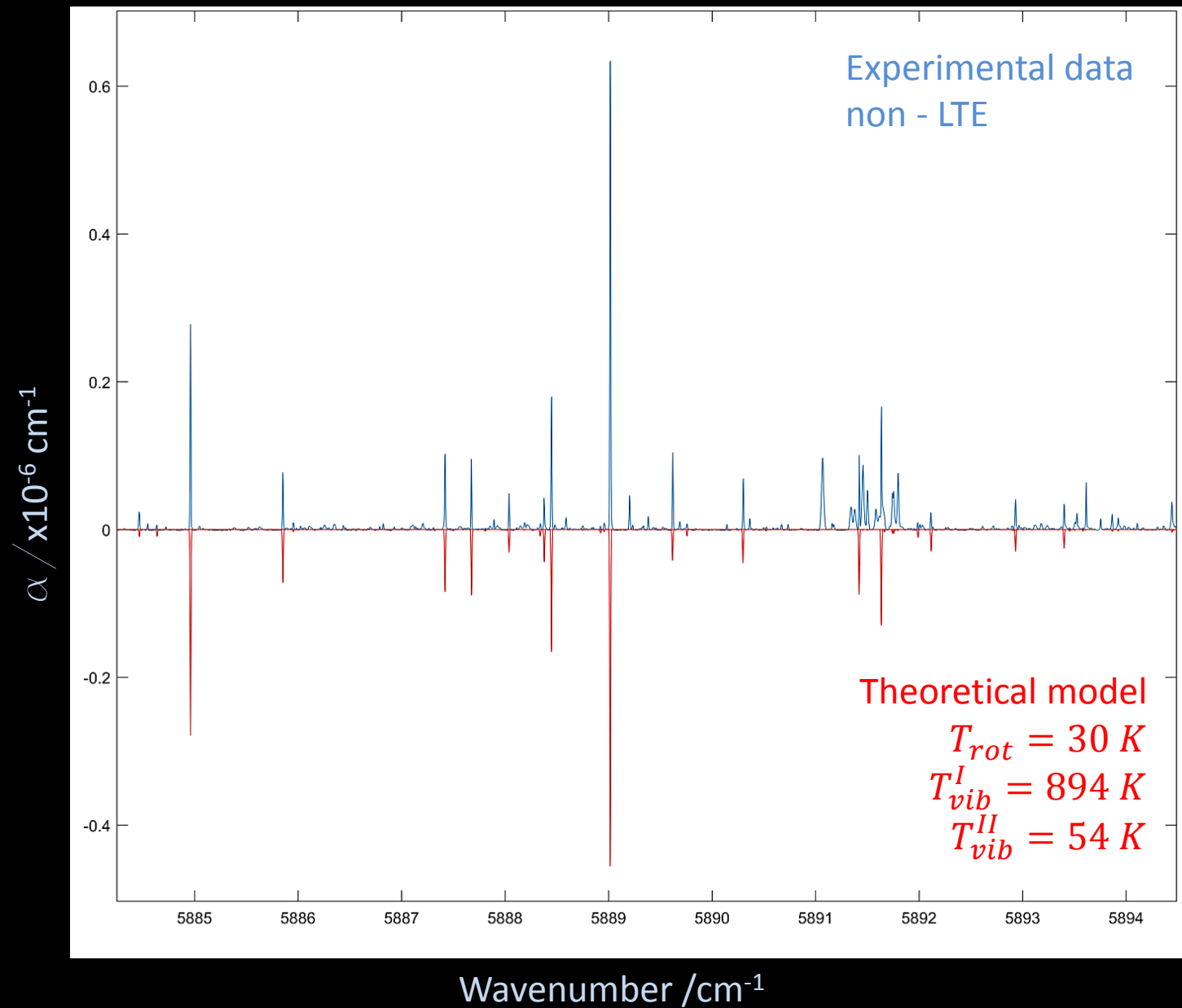


de Laval nozzle to create
hypersonic expansion

CO spectrum simulated in non-LTE
conditions $T_{\text{rot}} = 15\text{ K}$ and $T_{\text{vib}} = 2000\text{ K}$



Non-LTE spectroscopy of methane



MES SPECTRES SONT
COMPARÉS AUX OBSERVATIONS
ASTRONOMIQUES...

FLASH

... POUR MIEUX CONNAÎTRE LA
COMPOSITION DE L'ATMOSPHÈRE
DE CES EXOPLANÈTES !



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