The spectral characteristics of transiting extra-solar planets

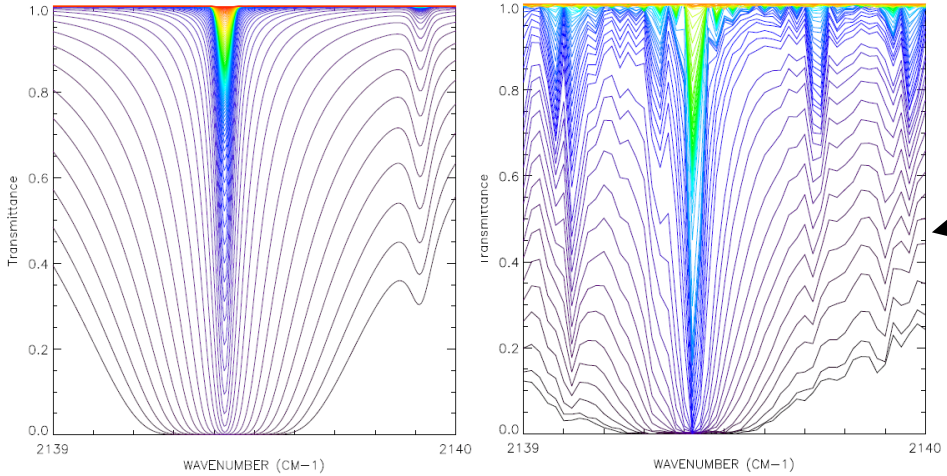
Jaemin Lee (AOPP, Oxford University)

- *Building a theoretical transit model for an extra-solar planet atmosphere*
  - *Aspects being considered:*
    - *Earth-like planets and extra-solar giant planets (EGP)*
    - *Spectral lines on both bodies (planet & parent star)*
    - *Parent star – rotational broadening effect, limb darkening, other events*
    - *Planet – transmittance, wind and global a*

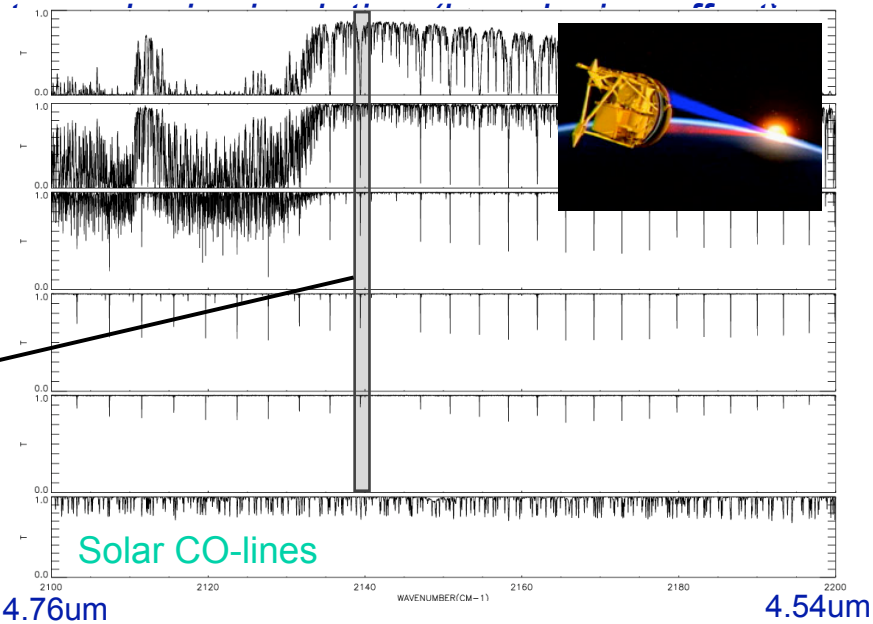
Earth transmission spectra

–Limb sounder : ACE-FTS (Solar occultation), HIRDLS, MIPAS

–Line-by-line forward model (RFM) – HITRAN database

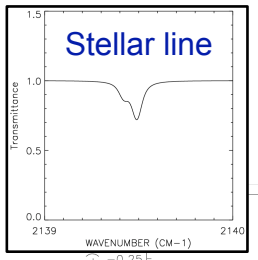


Transmittance at different tangential heights by RFM (left) and ACE-FTS (right).



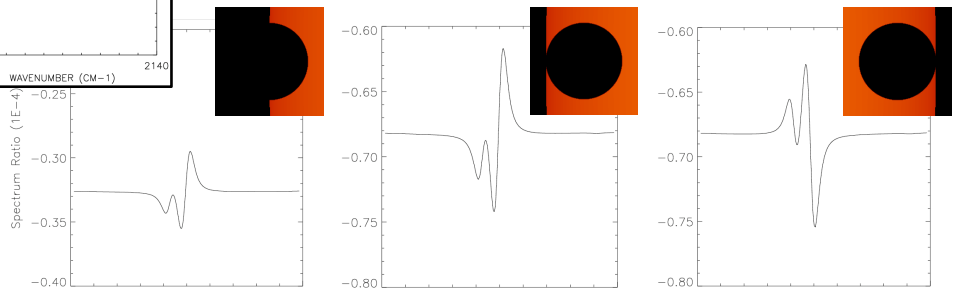
4.76um 4.54um

ACE-FTS occultation spectra (available from 2um to 13um)

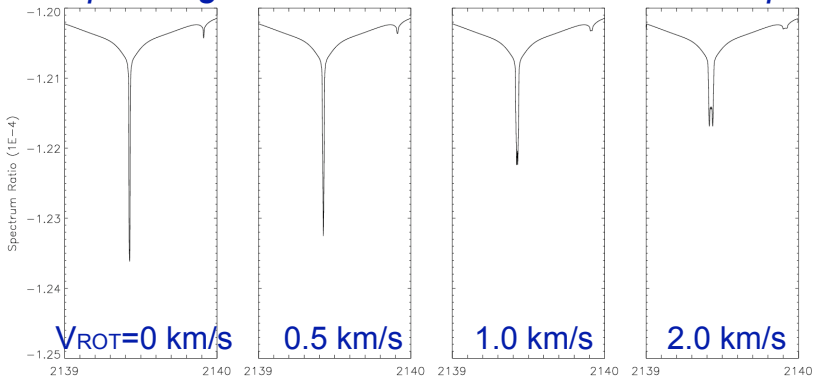


Narrow view

Stellar rotation & limb darkening effect

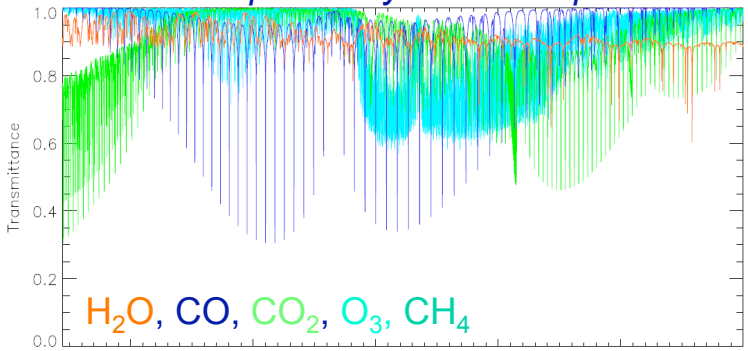


Atmospheric global rotation effect of extra-solar planet

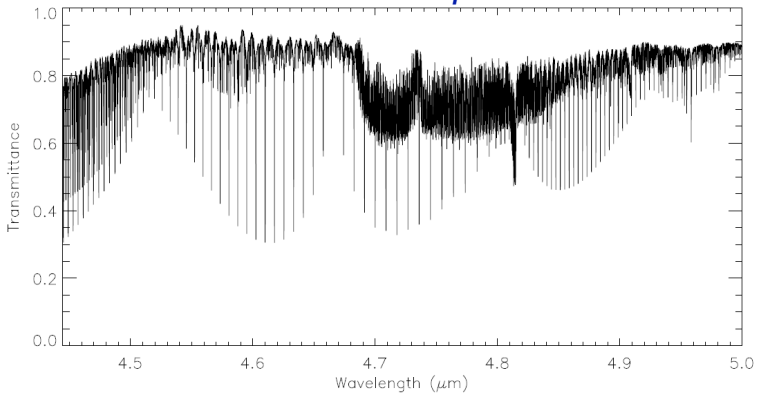


Broad view

Transit spectra by different species



Total transit spectrum



What we are thinking about

- Interfering sources (stellar variability, interstellar gas absorption, …)
- Transiting planets – ex. Venus
- Giant planets with its atmospheric rotation

Build general extra-solar planet model for transmission spectra and …

- Develop model with various constraints for EGPs
- Compare the model with previously observed data
- **Detectability study for Earth-like planets & EGPs**
- **Estimate the instrumental requirements for the detection of various extra-solar planets**
- Straw man study - Candidate telescopes