PROBING THE ABUNDANCE OF SIO AND HCN THROUGHOUT THE STELLAR WIND OF R DOR

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ABSTRACT

R Dor is an oxygen-rich AGB star characterised by a low mass-loss rate. Using **retrieval methods**, we found **abundance profiles for SiO and HCN**, two chemically important molecules. By comparing these results to those of **forward chemistry modelling** we will be able to constrain the dominant chemical pathways within the stellar wind. They will also enable us to **improve** the forward chemistry models, through incorporating dust-gas reactions. The same methodologies will be applied to the abundance profiles retrieved for the O-rich AGB star IK Tau (Decin et al. 2010), which is characterised by a high mass-loss rate.

R DORADUS

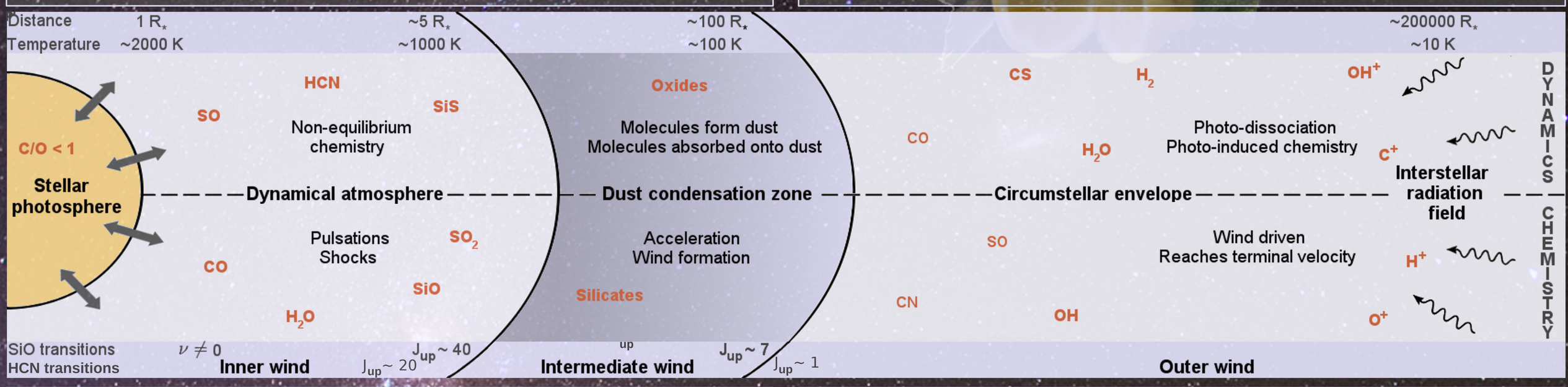
- Oxygen-rich AGB star
- Low mass-loss rate: 9 x 10^{-8} M_{sun}/yr
- Van de Sande et al. (in prep.):
  - Envelope model – dust and gas
  - Abundance profiles of SiO and HCN
- Data: SEST, APEX, Herschel HIFI, PACS, and SPIRE
- Future work: ALMA data

METHODS

One-dimensional, spherically symmetric codes

Retrieval
- In-house non-LTE radiative transfer code GASTRoNOoM (Decin et al. 2006, 2010)
- Models the thermodynamics and kinematics of the wind and abundance profiles of molecules

Forward chemistry
- Based on UMIST database (McElroy et al. 2013)
- Gas-phase reactions only
- Yields abundance profiles and chemical pathways



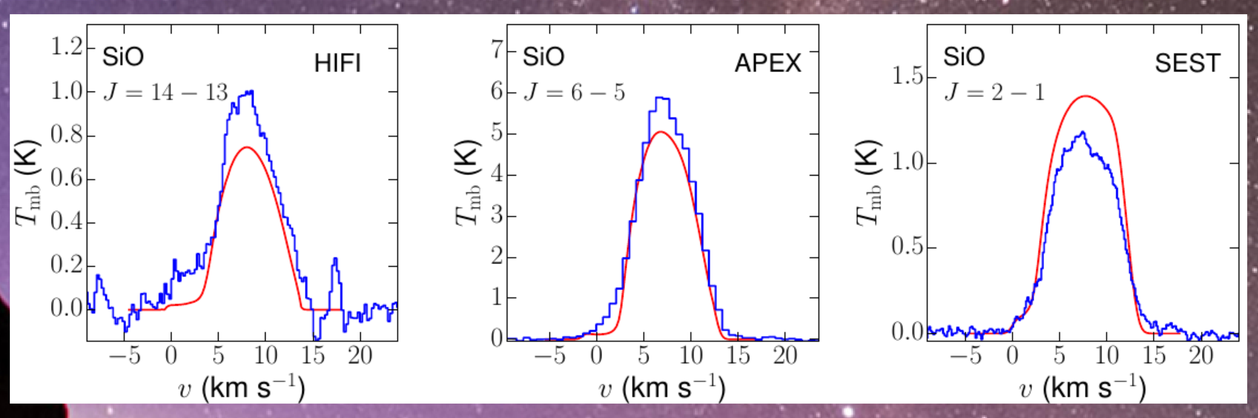
Physical structure (derived from CO) → Radiative transfer → Ray tracing of emission lines → **Abundance profile**

RETRIEVAL

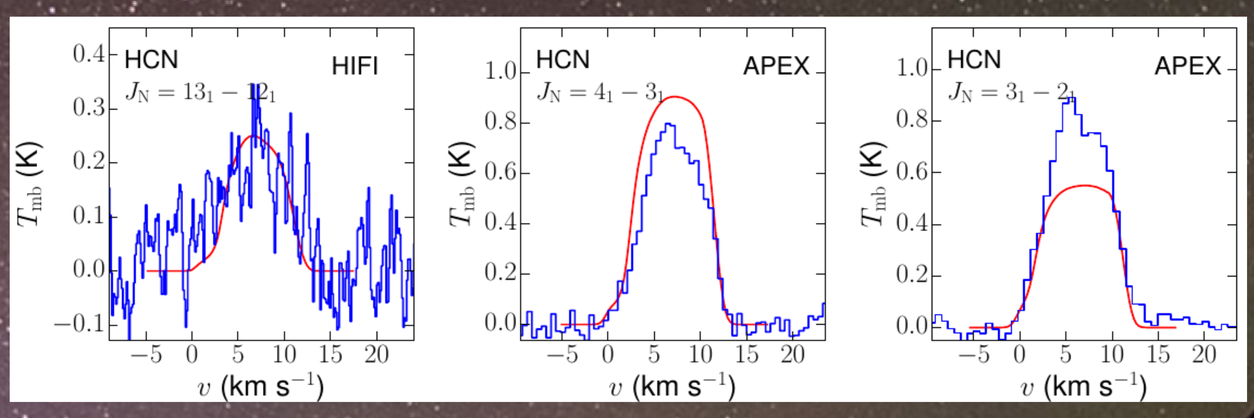
Parent species + Physical structure → Chemical network → **Abundance** profile + Chemical pathways

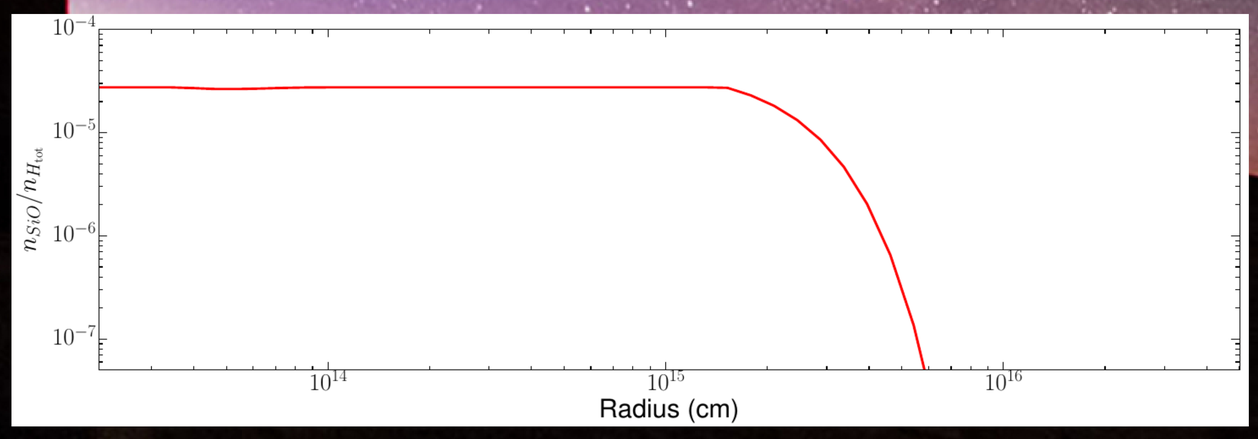
FORWARD CHEMISTRY

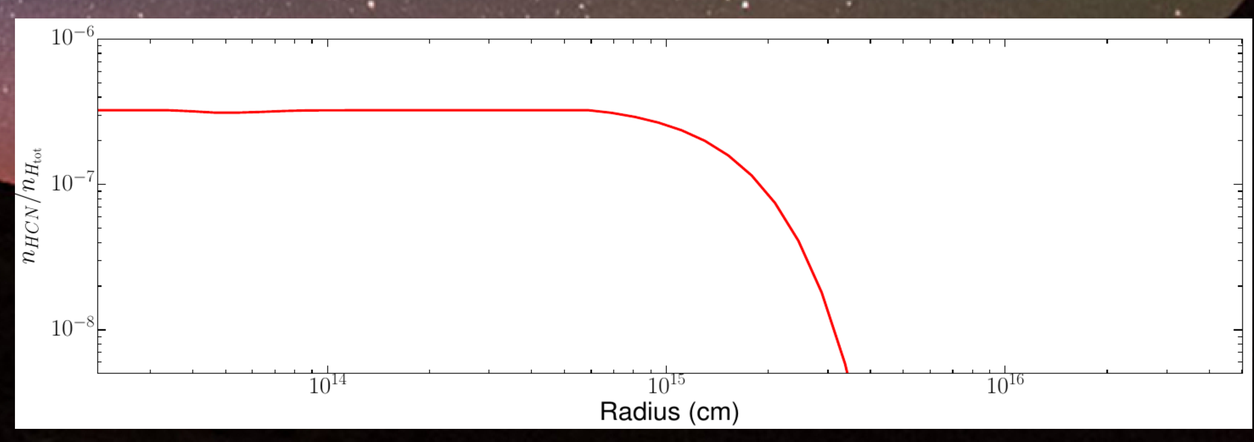
SiO



HCN







RESULTS

- Range in abundance profiles
  - → Indistinguishable fit to molecular data
  - → Criteria: integrated line flux (line strength)
    log-likelihood function (line shape)
- Range well constrained
  - → Allows for comparison to forward chemistry model
- No evidence of condensation of SiO onto dust grains ⟶ ALMA

FUTURE WORK

- Compare with forward chemistry models
  - → Gas-phase reactions only
  - → Include dust-gas reactions
- Compare forward chemistry models to results of IK Tau
  - → High mass-loss rate and low mass-loss rate
  - → Difference in dominant pathways, dust nucleation...

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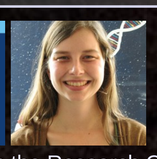

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