MIDNIGHT MOLECULES

PHOTODISSOCIATIONS AND TRANSPORT-INDUCED CHEMISTRY ON HOT EXOPLANETS

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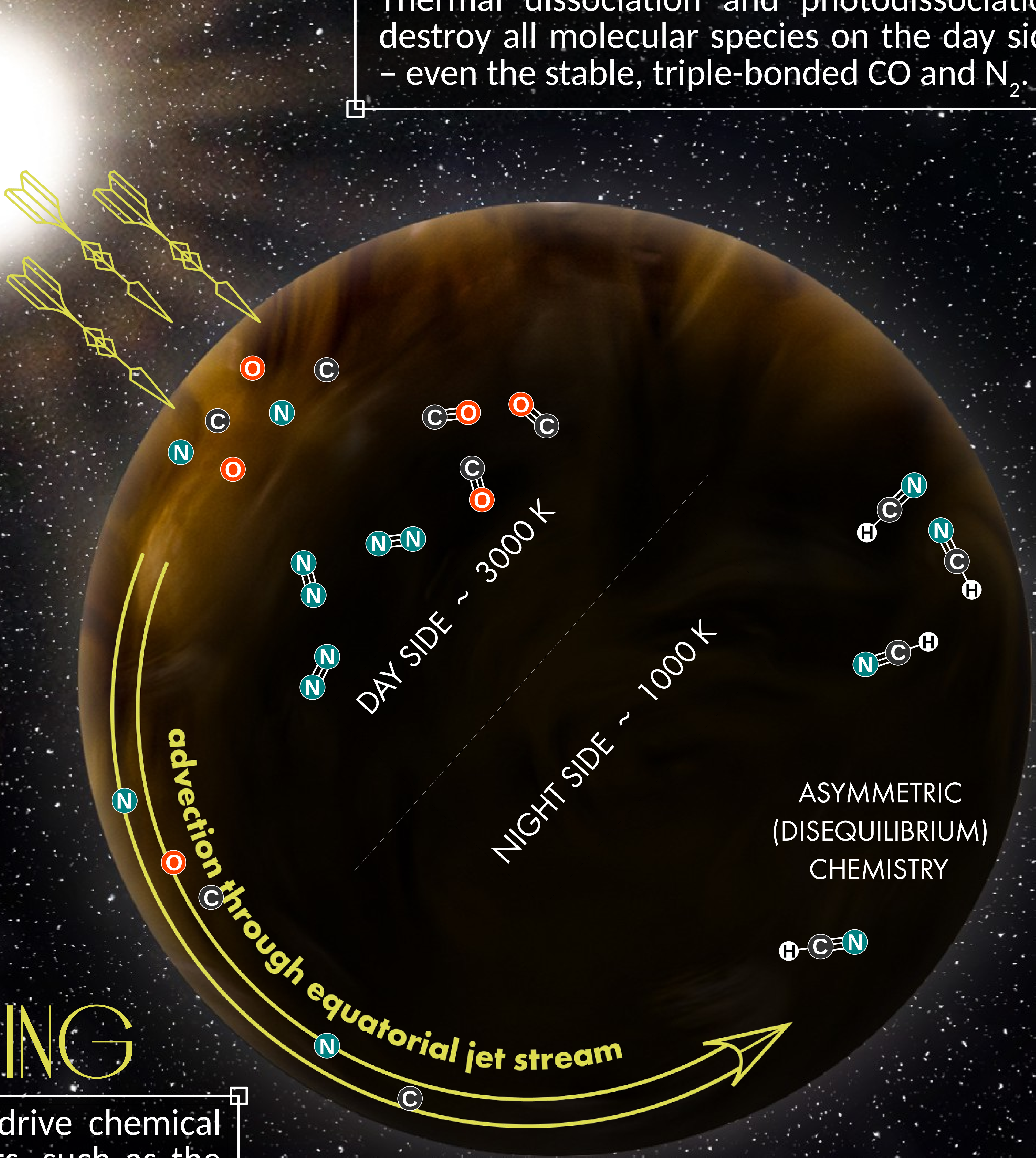
CHALLENGE Understanding the chemical composition of exoplanet atmospheres requires insight in the dominant physical and chemical processes taking place, including **photochemistry** and **wind advection**. The issue is exacerbated for hot irradiated planets, which are **intrinsically three-dimensional**.

STRATEGY We model the atmosphere of the ultra-hot Jupiter WASP-76 b using a **3D climate model** *(expeRT/MITgcm, Carone+2020, Schneider+2022)* and a **photochemical kinetics model** *(Agundez+2014)*.

FIRST KEY FINDING

Thermal dissociation and photodissociation destroy all molecular species on the day side – even the stable, triple-bonded CO and N_2.



SECOND KEY FINDING

Photochemistry has a global impact on the chemical composition, as fast (km/s) winds can carry free radicals from the day side to the night side.

THIRD KEY FINDING

Disequilibrium chemistry can drive chemical asymmetries on hot exoplanets, such as the measured HCN signal on the morning limb of WASP-76 b *(Sanchez-Lopez+2022)*.

OUTLOOK The removal of coolants through photodissociation pushes the atomic-molecular transition to higher (> µbar) pressures, causing a **deep thermosphere/ionosphere**. Future self-consistent modelling should determine if such thermosphere persists on the night side and which ions may be observable...

WANT TO KNOW MORE ?

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GET IN TOUCH!

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