

SUPER:

Sulfur Understanding through Photochemistry and Exoplanetary Research

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- ✓ JWST discovered SO₂ in warm/hot H/He atmospheres (1,2,3)
- ✓ Sulfur as a probe of photochemistry and planet formation(4)

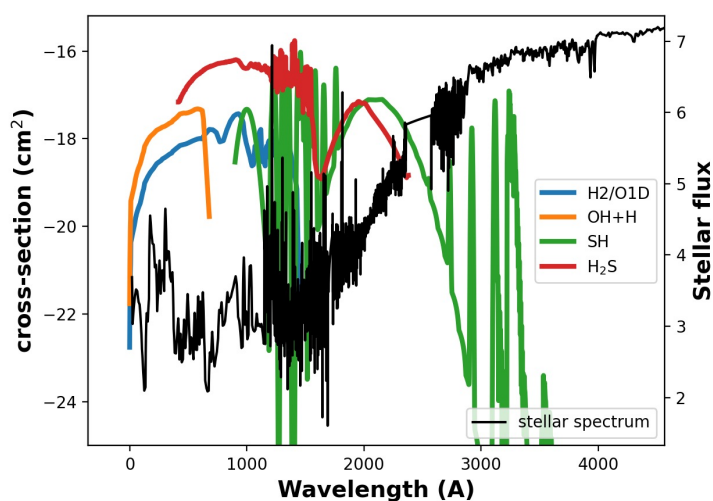
Sulfur photochemistry

- ✓ SH, H₂O photodissociate @ 10⁻⁴ / 10⁻⁶ bar
- ✓ SO₂ formation in upper atmosphere

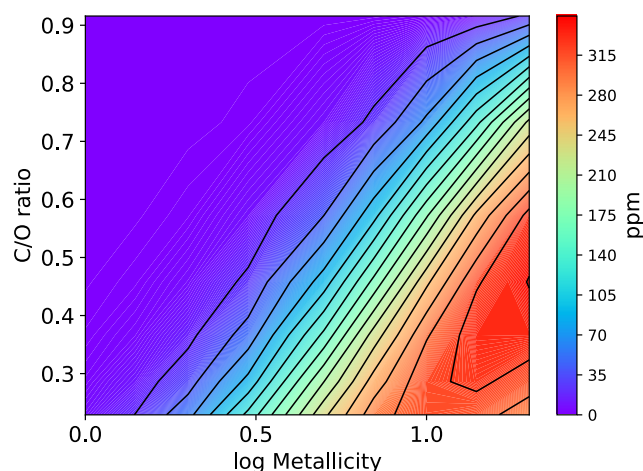
Gas giant planet formation

- ✓ Sulfur is refractory in disks(5)
- ✓ Tracer of metallicity (6,7)

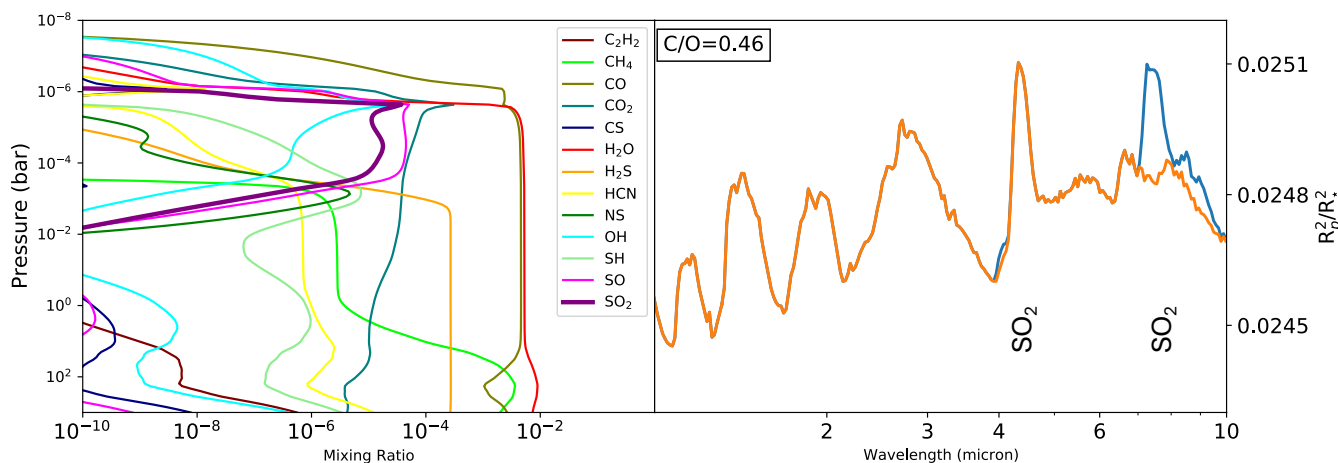
Effect of stellar radiation field on sulfur photochemistry?



SED of HD106315 with assumed solar EUV/FUV flux levels, and photodissociation cross-sections of molecules involved in sulfur photochemistry



Strength of the 7.4 μm SO₂ band (PPM) in transmission spectra as a function of C/O ratio and metallicity(4)



Left: VULCAN⁽⁸⁾ HD189733b forward model mixing ratios of relevant molecules, assuming 10x solar metallicity, $R_p=1.138 R_J$, $R_*=0.805 R_\odot$. **Right:** Transmission spectrum with and without SO₂.

SUPER:

- ✓ JWST Cycle II program 2950
- ✓ 3 planets in transit with MIRI
- ✓ XMM-Newton for HD106315
- ✓ SWIFT NUV monitoring planned
- ✓ Retrievals including photochemistry

SUPER TARGETS:

Planet name	Mass (M _J)	T _{eq} (K)	Host star
HD106315c	0.05	890	F5V
HAT-P-1b	0.53	1320	G0V
HAT-P-11b	0.07	880	K4

References: ¹ Alderson+, Nature 614, 664; ² Tsai+, Nature 617, 483 ³ Dyrek+, Nature 625, 51; ⁴ Polman+, A&A 670,161; ⁵ Kama+, ApJ 885,114; ⁶ Turrini+, ApJ 909, 40; ⁷ Khorshid+, A&A 667,147; ⁸ Tsai+. ApJ 923,264