Mars UV-Visible airglow observations and predictions for EXOMARS-TGO

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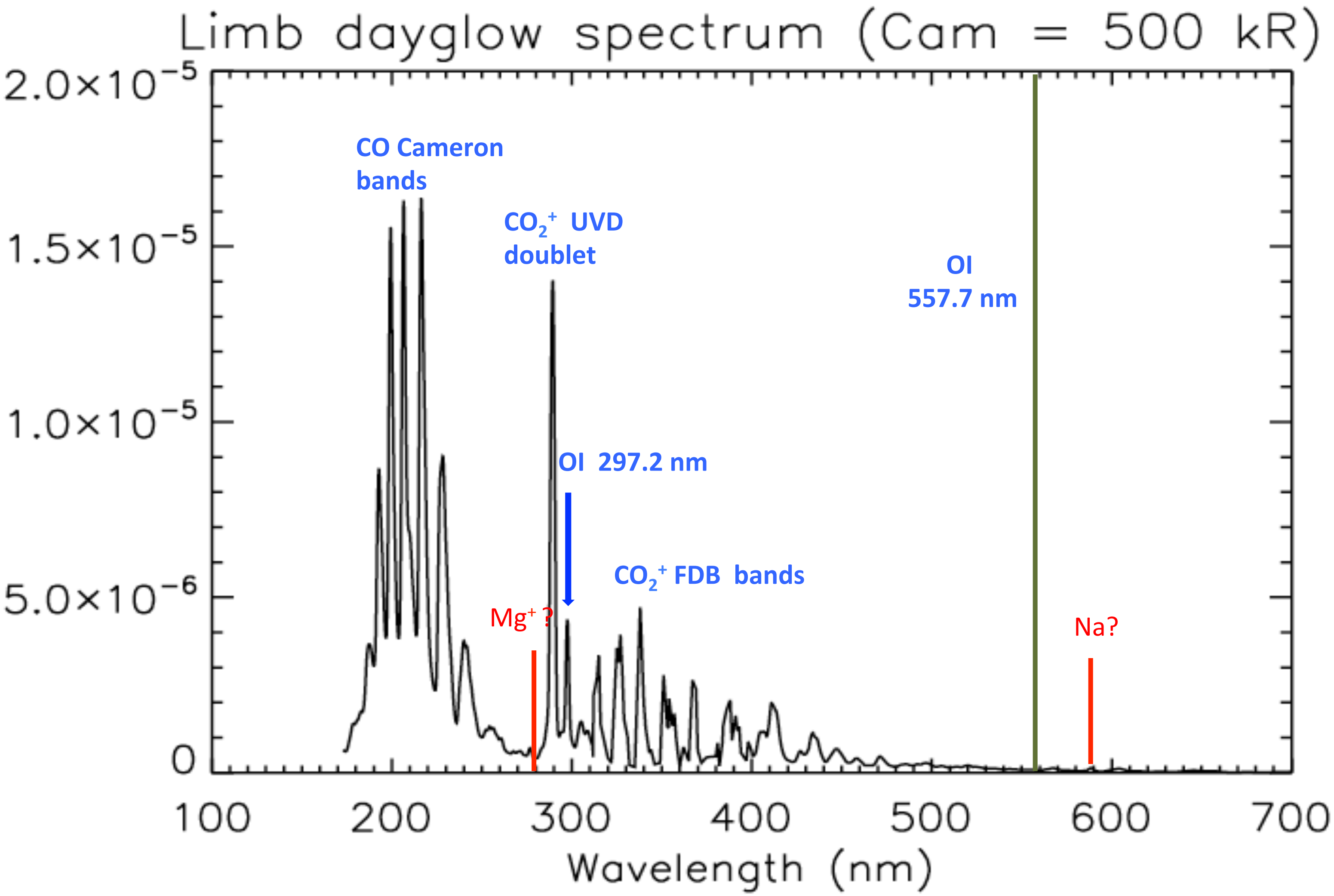
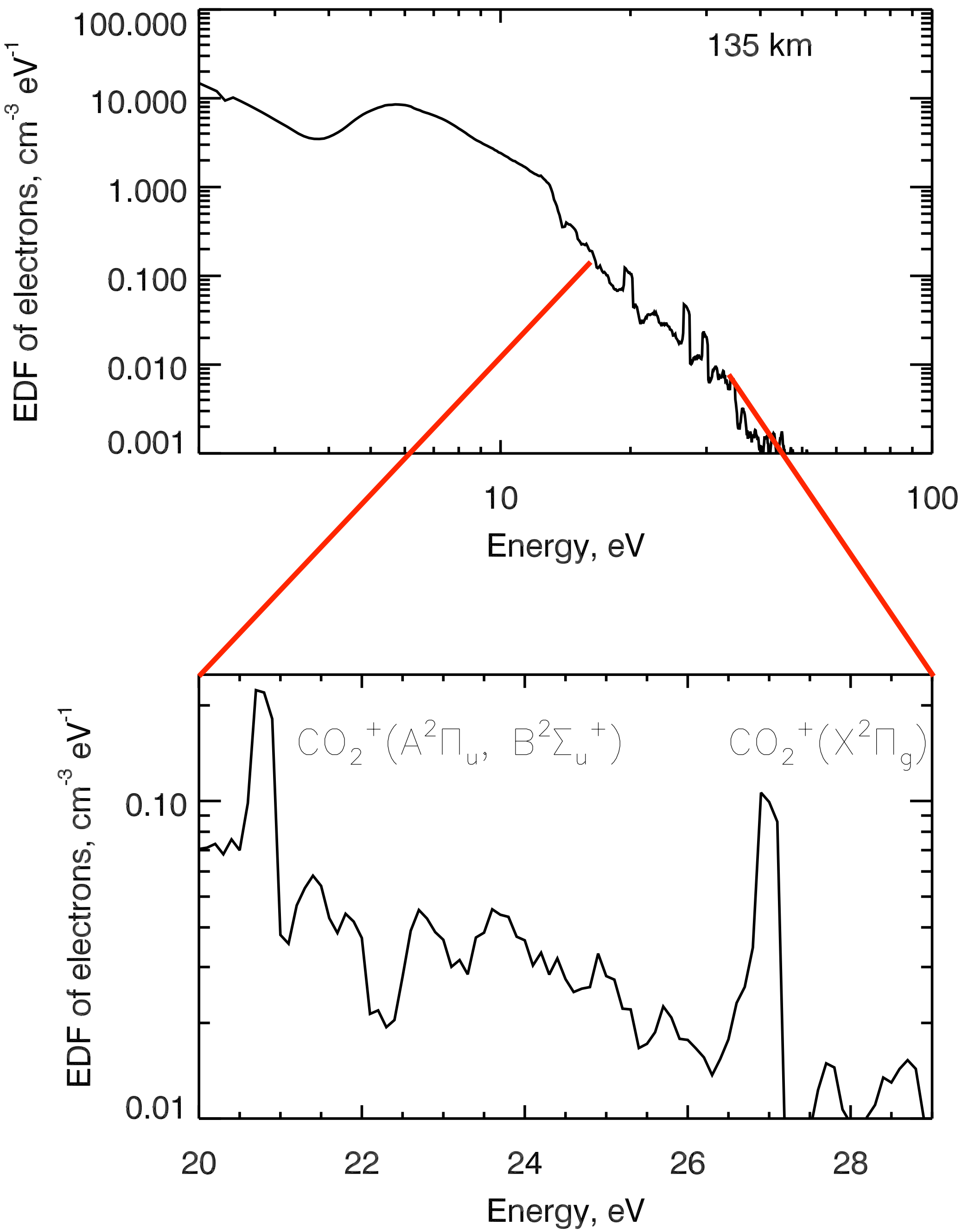
TGO capabilities for upper atmosphere science (López-Valverde et al., 2018)

Confidence level	Science target	Topic[d]	Nomad + ACS channels	Observation modes[a]
Likely detection	NO nightglow in NADIR	VI, VII	UVIS	Nominal Nadir mapping
	O_3 at the day-night transition	II, V, VI	UVIS	Nominal S.Occ
	Thermospheric temps from NADIR CO_2 fluorescence at 4.3 μm	I, IV, VI, VII	TIRVIM	Nominal Nadir mapping
	NO Nightglow High Lats	VI, VII	UVIS	LSoffT 1, 2
	OH Meinel Bands in the polar night	VI	LNO + NIR	LSoffT 1, 2, 4
	Aurora in solar storms period	I, II, VI	UVIS	LSoffT 2
	O_2 1.27 μm Nightglow High Lats	II, VI, VII	NIR	LSoffT 2, 3
	UV dayglow and Thermospheric Temperatures from their limb profiles	I, VI	UVIS	LSoffT 2, 3, 4
	Very high altitude H_2O ice clouds	III, V	NIR + UVIS	LSoffT 2, 3
	Thermospheric Plumes	I, III, V, VI	LNO + NIR + UVIS(+TIRVIM)	LSoffT 1, 2, 3 (4)

Dayside

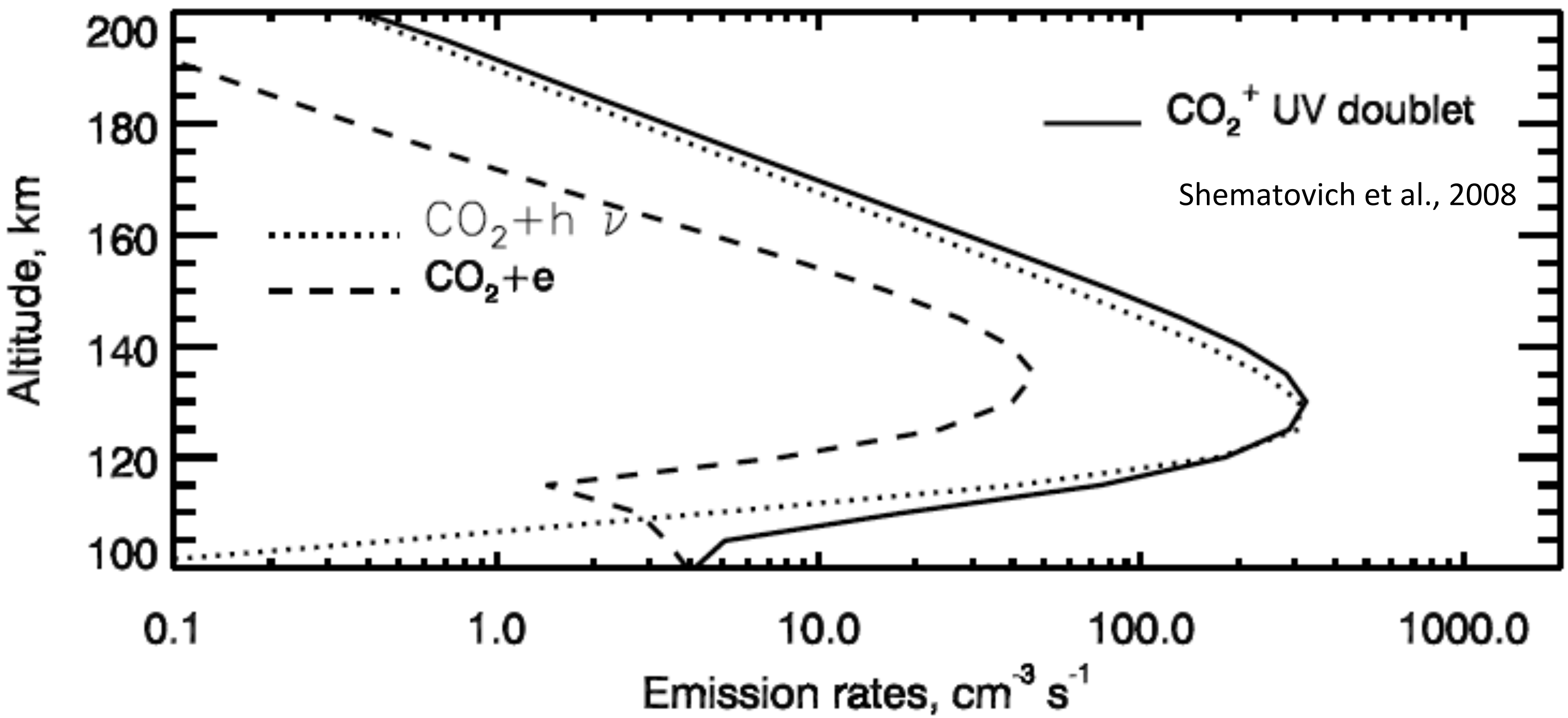


Two types of excitation sources: direct solar photons + photoelectron impact

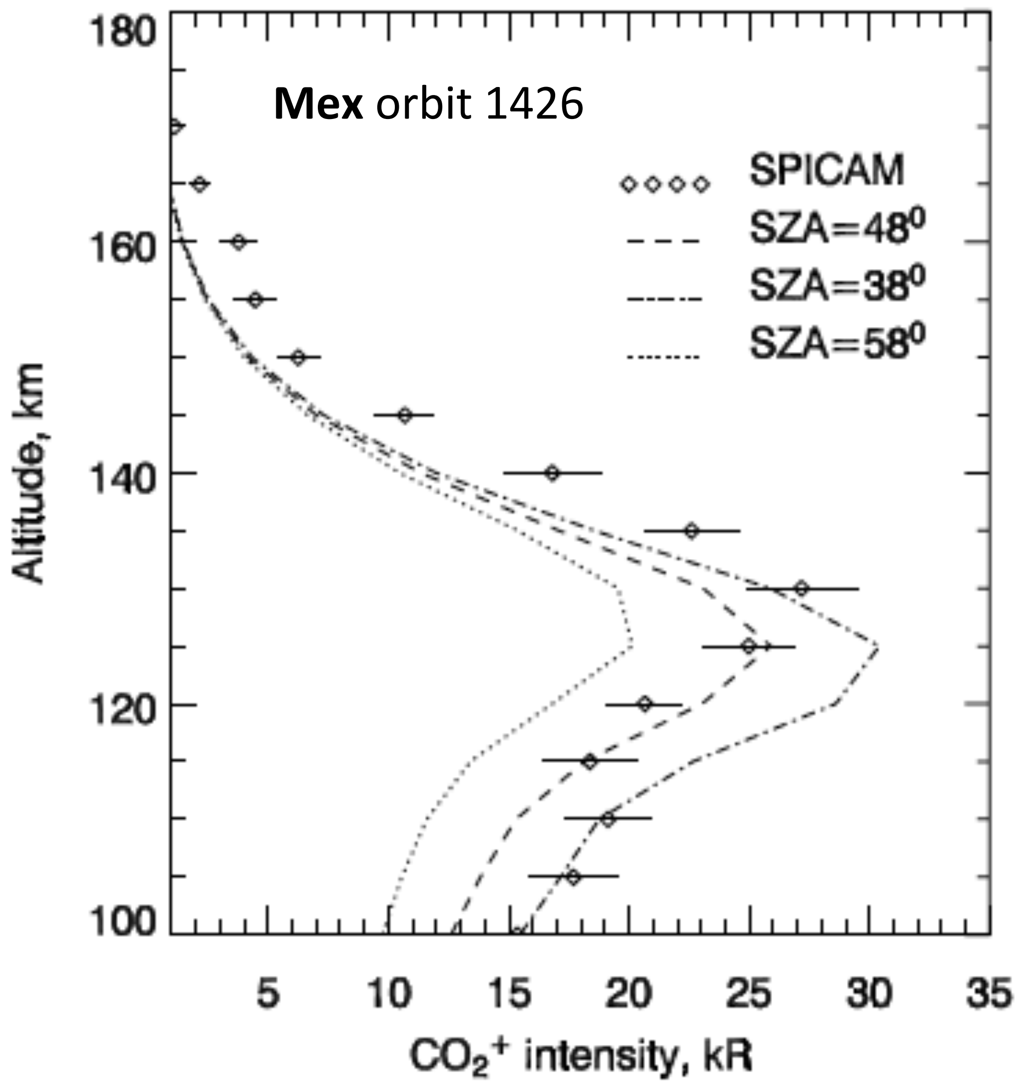


Calculated energy distribution function of photoelectrons at 135 km

Zoom on panel (a).
The two peaks correspond to the ejection of photoelectrons with CO_2^+ ions in different electronic states

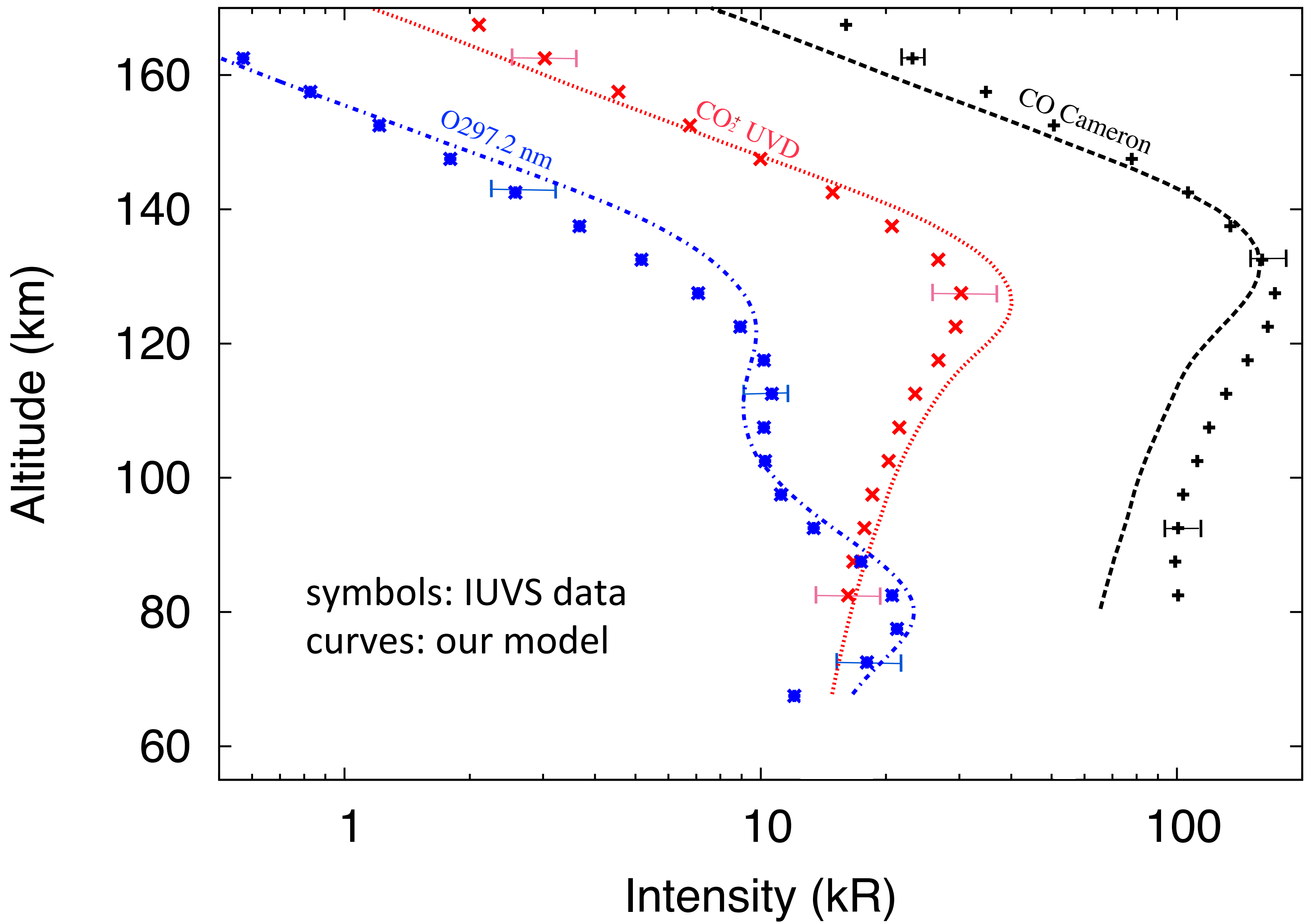


Sources of CO_2^+ UV doublet emission in the Martian atmosphere
→ both production rates depend on the CO_2 density

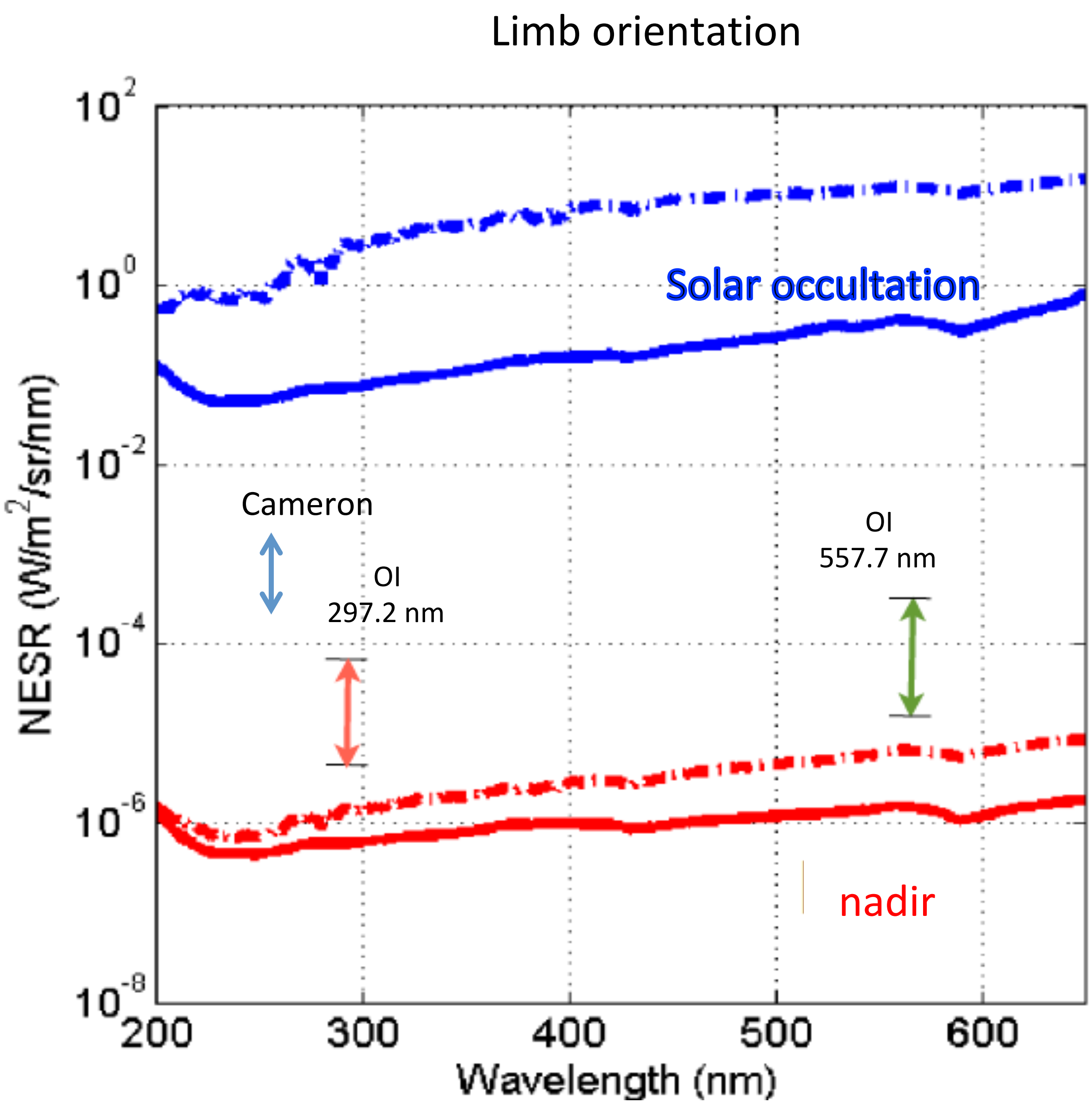


Limb profiles of calculated and observed $CO_2^+(B^2\Sigma^+ - X^2\Pi)$ band system emission rate from SPICAM (orbit 1426)

Average limb profile of several dayglow emissions from IUVS/MAVEN within the bandpass of the UVIS/TGO instrument



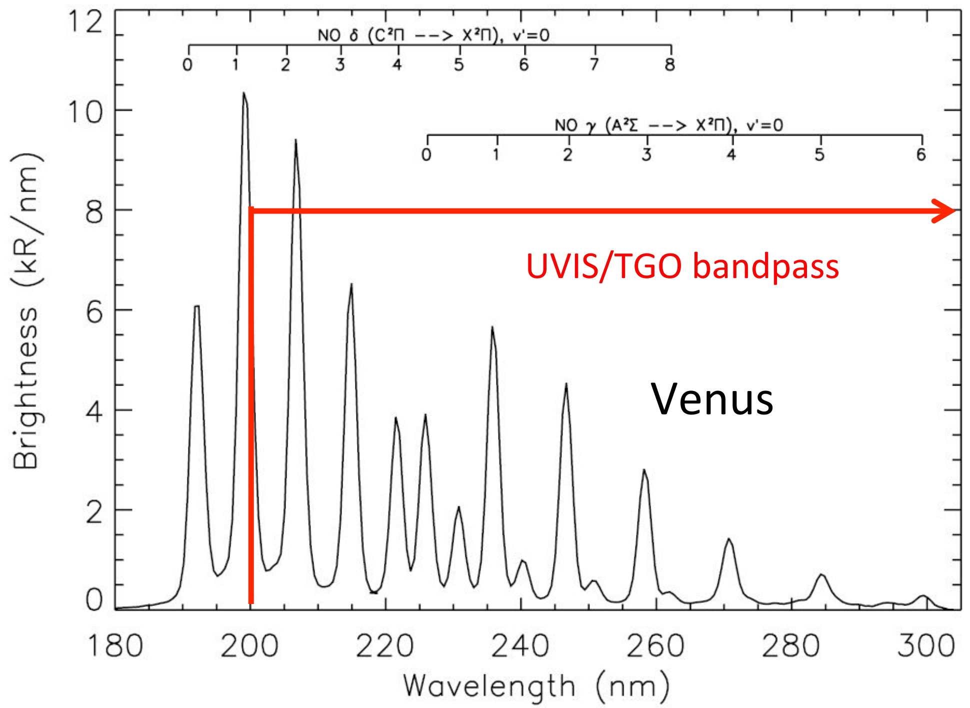
Observability by UVIS/NOMAD



NESR from Vandaele et al.

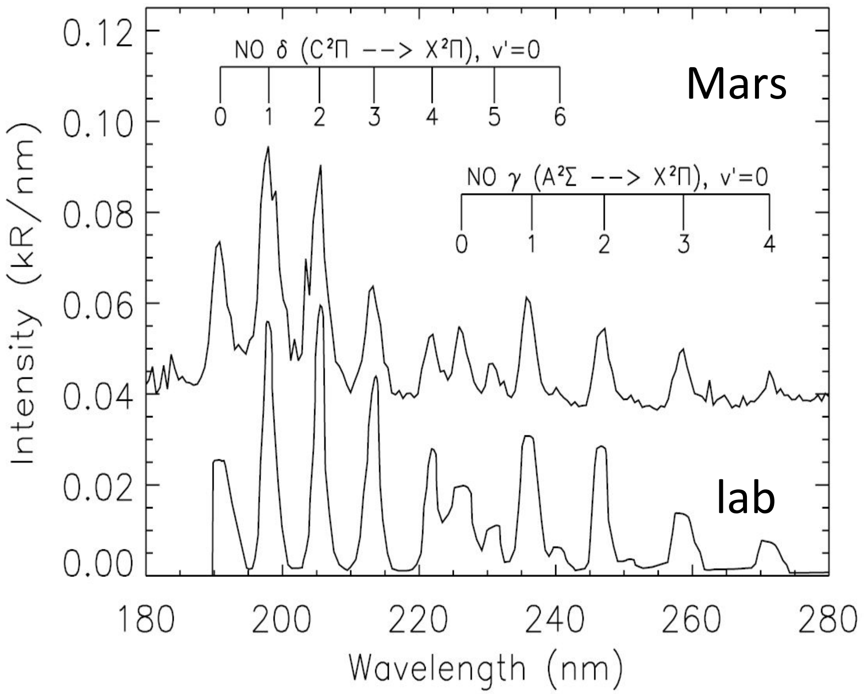
Nightside

(aurora: next talk)



SPICAV nightglow spectrum

Gérard et al., 2008



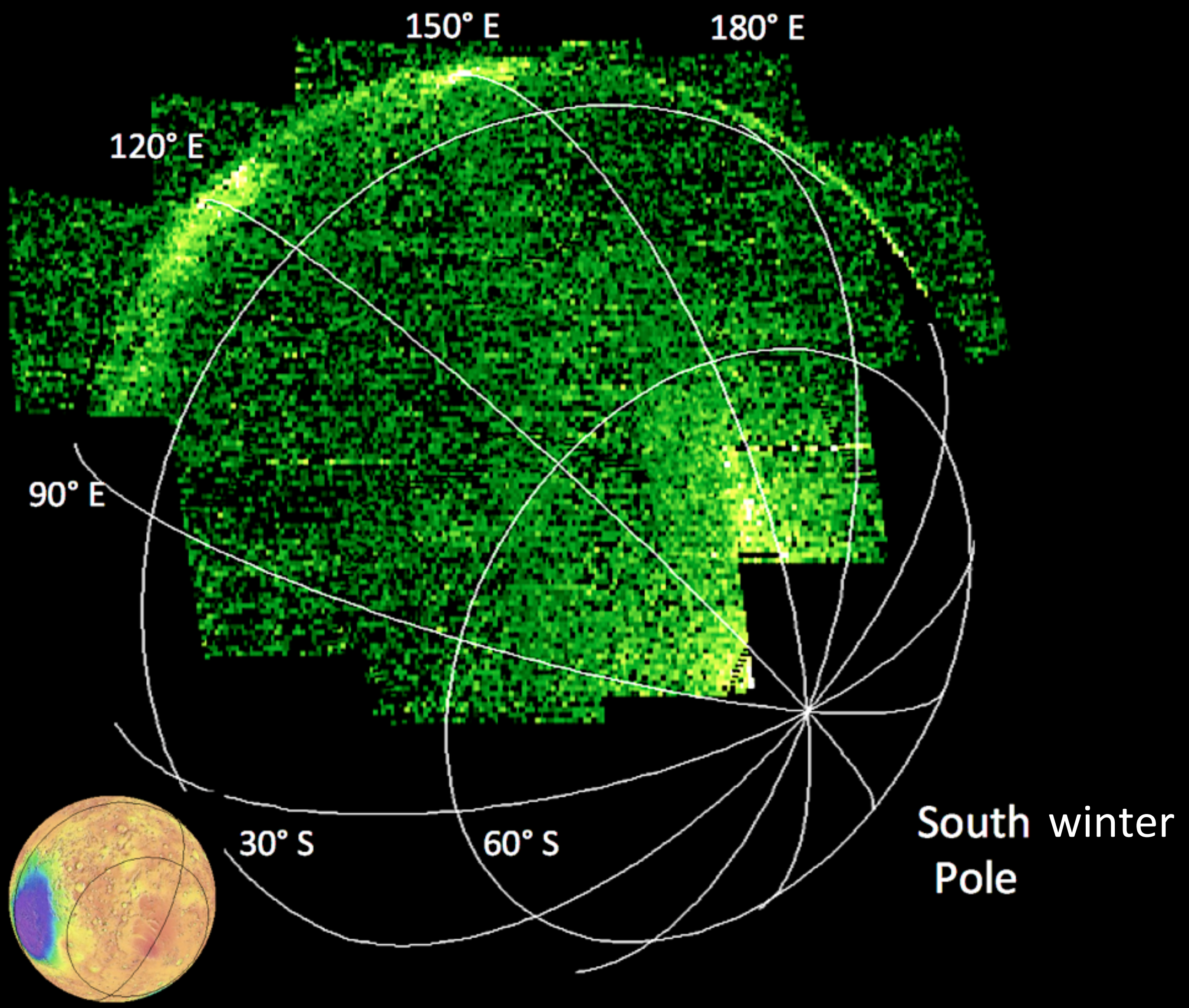
SPICAM nightglow spectrum

Cox et al., 2008

N + O → NO*

NO* → γ + δ bands

MAVEN apoapsis image of the NO nightglow distribution



IUVS team

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Recommendations for TGO operational tests:

- Nadir nightside observations of NO FUV spectrum when the spacecraft is in eclipse

- Nadir nightside observations of aurora (discrete, diffuse) from enhancement of specific spectral features

- Limb dayside observations with UVIS nadir channel oriented to scan the limb between 150 and 60 km

A key question:

How well do the CO_2 and O density derived from airglow observations agree with and complete other methods (*in situ*, atmospheric drag, occultation, modeling) ?

Thank you