VALIDATION OF A WAVE HEATED 3D MHD CORONAL-WIND MODEL USING POLARIZED BRIGHTNESS AND EUV OBSERVATIONS

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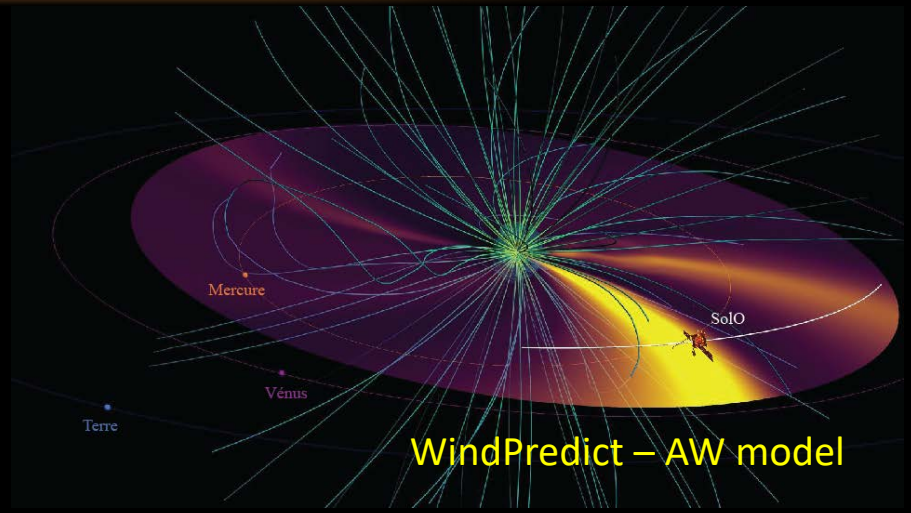

Parenti et al. ApJ, 929, 2022

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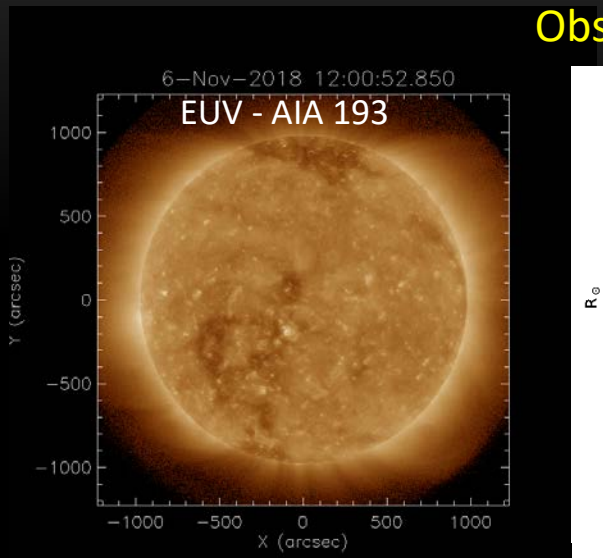
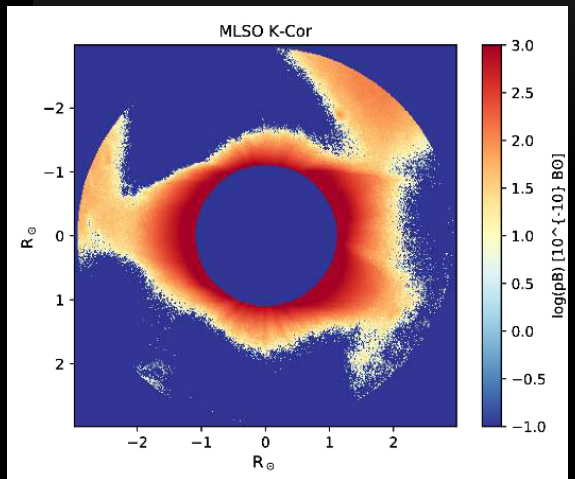
OBSERVATIONS AND SYNTHETIC DATA

Observations: 6 & 7 November 2018

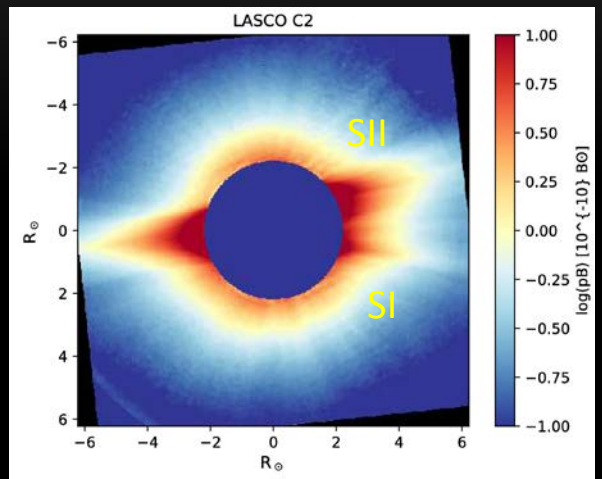


- logT = 6.2; R < 1.5
- **I ~ f(N^2, T)**



WL pB - MLSO K-Cor:

- ~1.2 < R < ~ 2.2
- I ~ f(N)



WL pB LASCO:

- 2.2 < R < ~ 6
- I ~ f(N)

The building of synthetic images

MHD Model Outputs in 3D: N, T ➡ 3D pB and EUV ➡ 2D pB and UV

Synthetic images obtained using *Tomograpy* (*Barbay et al. 2013*)

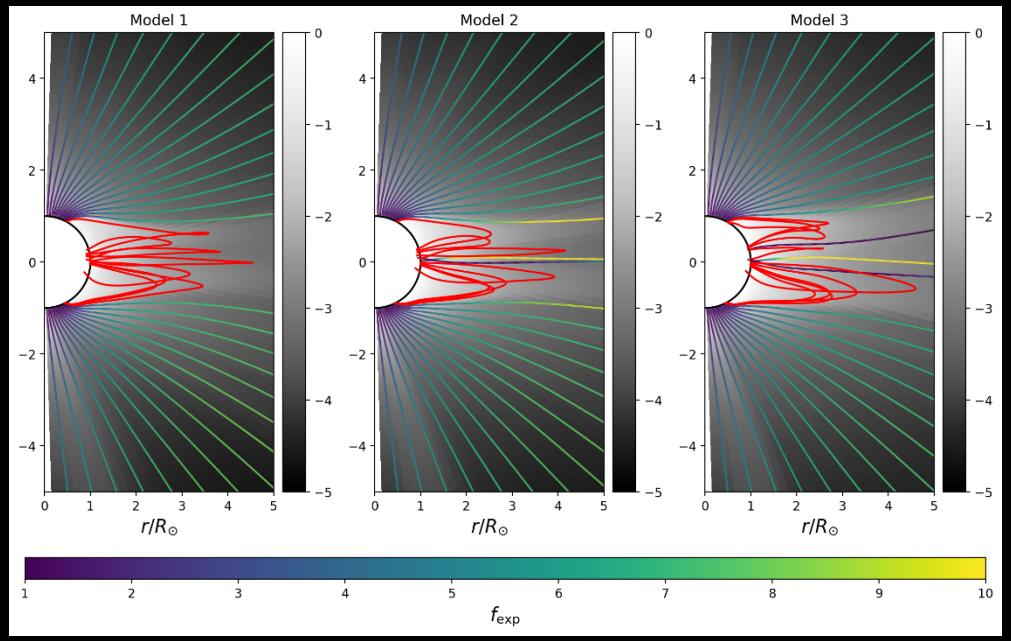
WIND PREDICT – AW GLOBAL MODEL

- Input: Photospheric ADAPT map (Br)
- PLUTO 3D MHD code with additional:
  - Evolution of Alfvén waves packets from the inner boundary of the simulation
  - Turbulent dissipation in the solar wind.

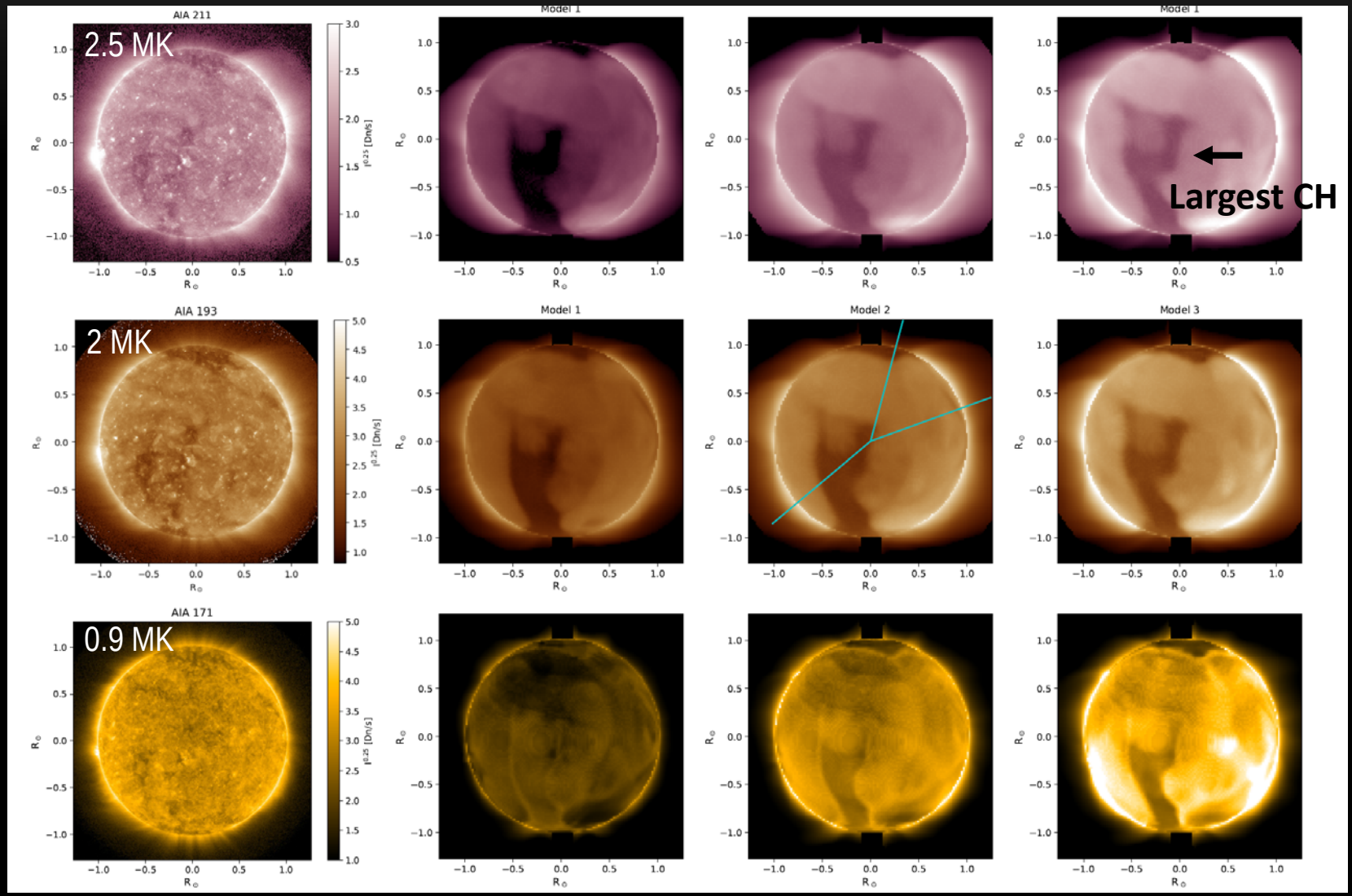
Réville et al. 2020:
Accurate reproduction of the in-situ PSP first perihelion data.

This work: Test the model at the Sun

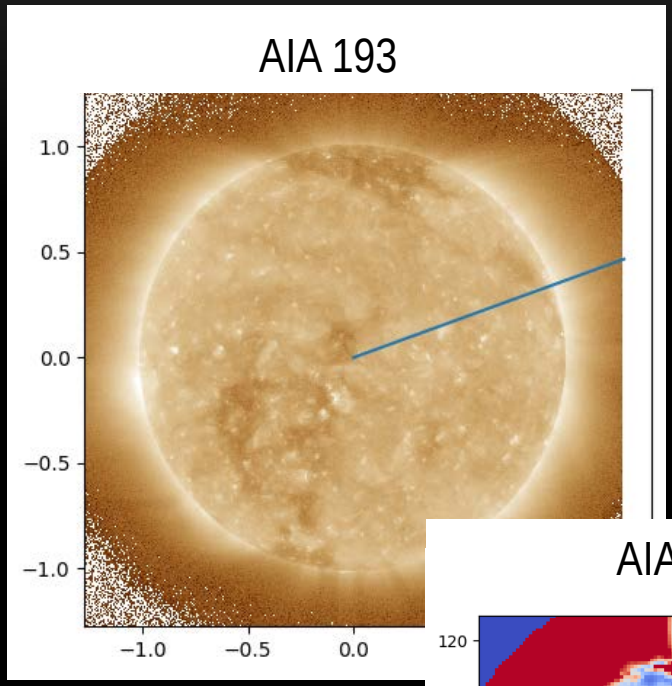
Parameter	Model 1	Model 2	Model 3
$\delta v_\odot$ (km/s)	48	36	36
$\rho_\odot$ ($10^8 m_p$ cm^{-3})	1	2	3
$\langle B_r(R_\odot)\rangle$ (G)	1.8	1.8	1.8
F_h (10^5 erg.cm^{-2}.s^{-1})	0.2	0.2	0.2
$\langle F_w\rangle$ (10^5 erg.cm^{-2}.s^{-1})	1.5	1.2	1.5

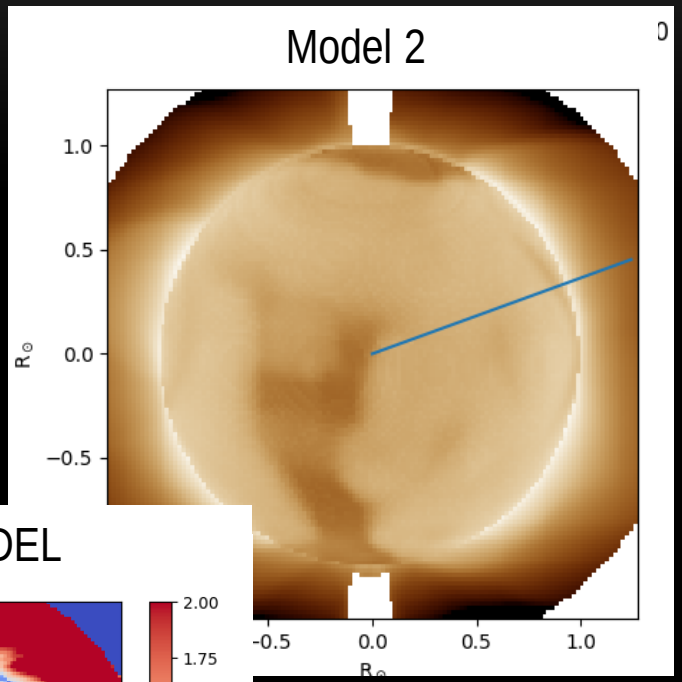


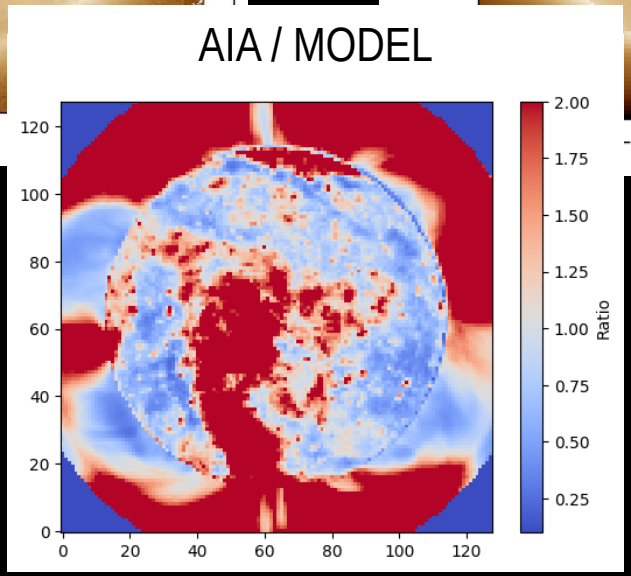
SIMULATED CORONA AT DIFFERENT TEMPERATURES



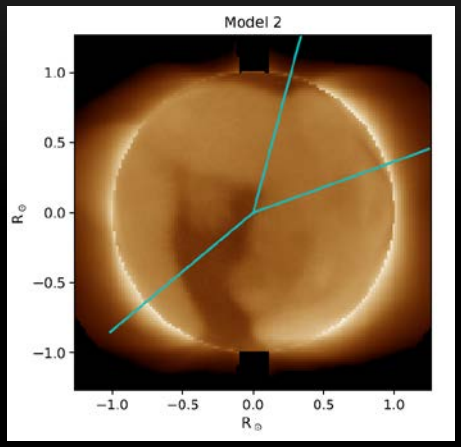
PERFORMANCE OF THE MODEL FROM EUV FULL SUN IMAGES





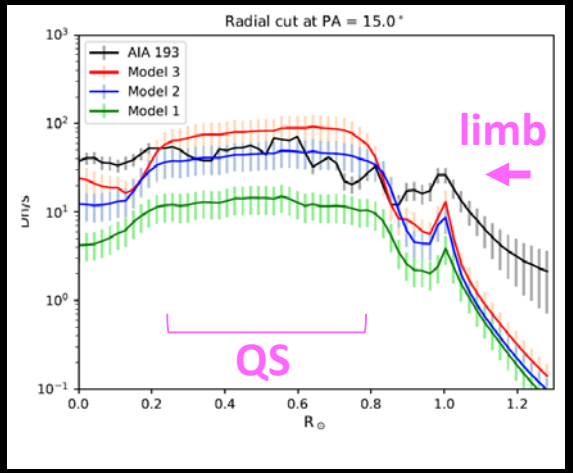


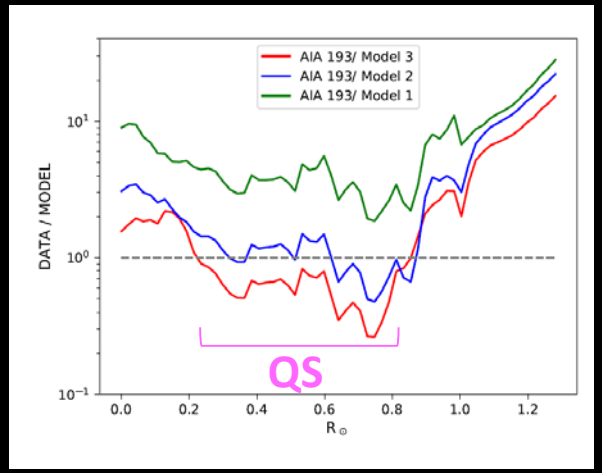
QUANTITATIVE COMPARISONS (QS AND CH): AIA 193 RADIAL PROFILES

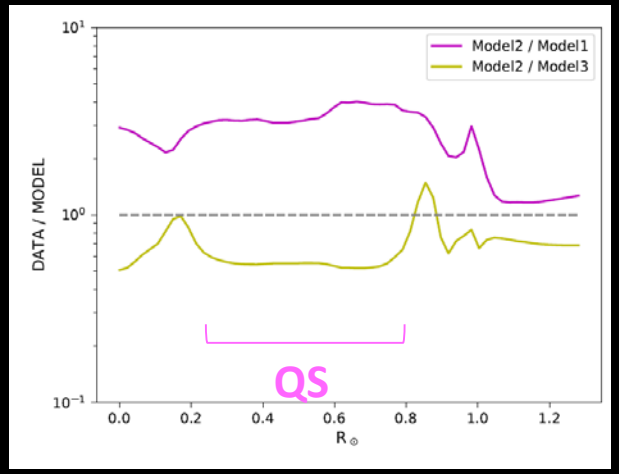


- QS: Model 2 well reproduces the observation
- CH: Intensity too low in the models.
  - Part of the TR emission emission is missed in the WindPredict-AW;
  - 50% of stray light in AIA 193 (Saqri et al. 2020)

CH CH CH CH CH CH







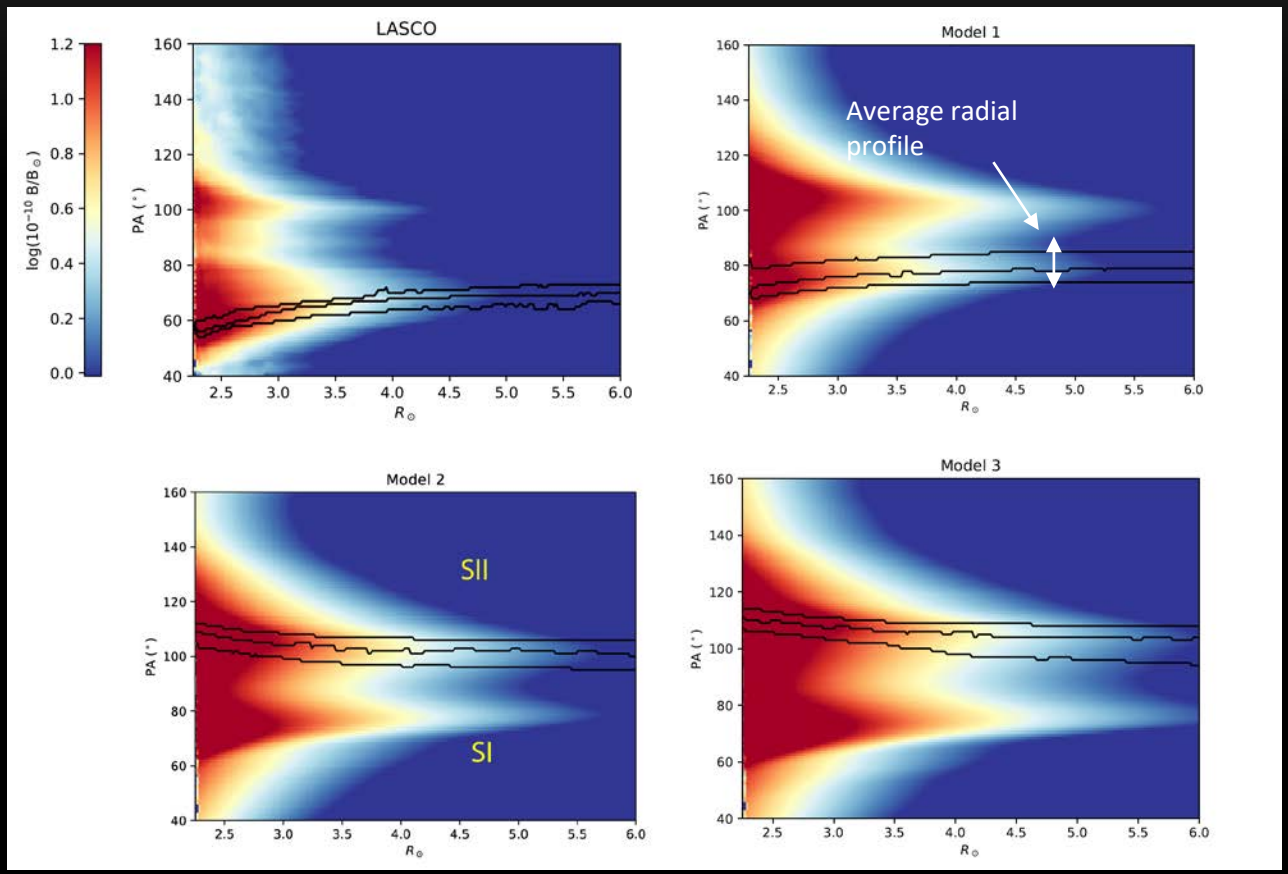
SIMULATED WEST-SIDE CORONA FROM LASCO: NOVEMBER 6

Equator

North

Equator

North



- S I and S II are reproduced but with a too high intensity
- Model 3 shows a higher latitudinal extension

➡ Radial intensity decay

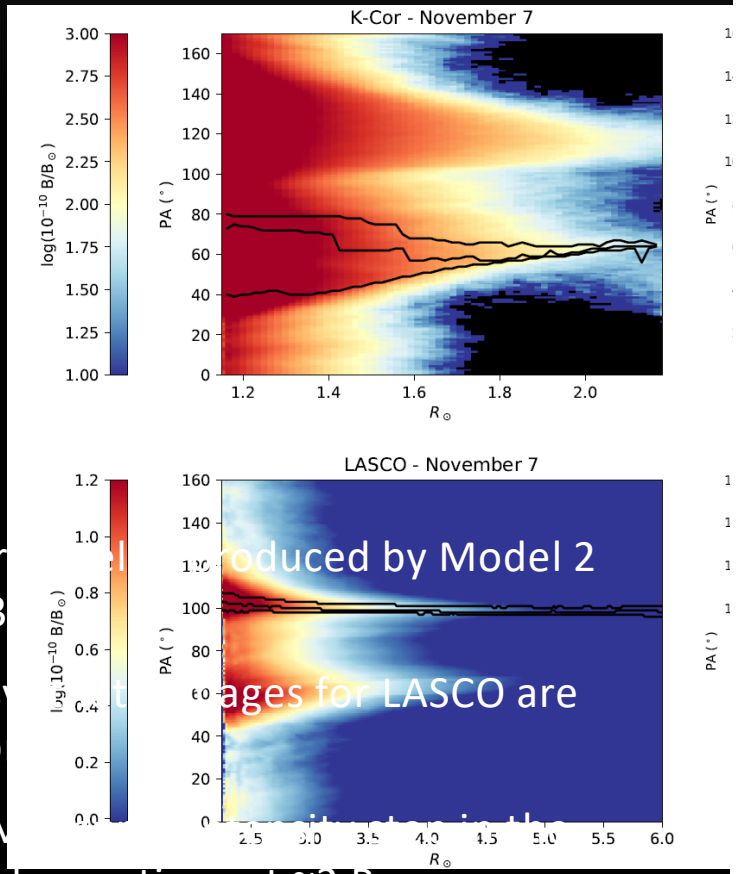
REPRODUCING THE INTENSITY FALL-OFF IN THE WEST CORONA: NOVEMBER 7

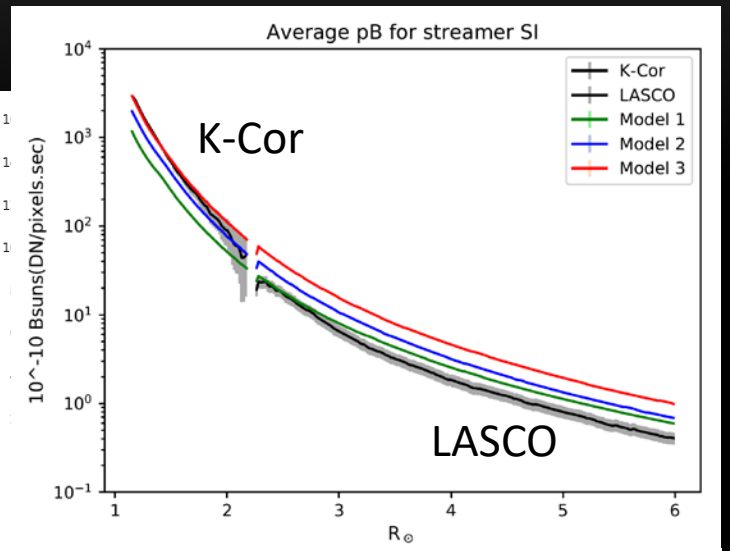
Equator

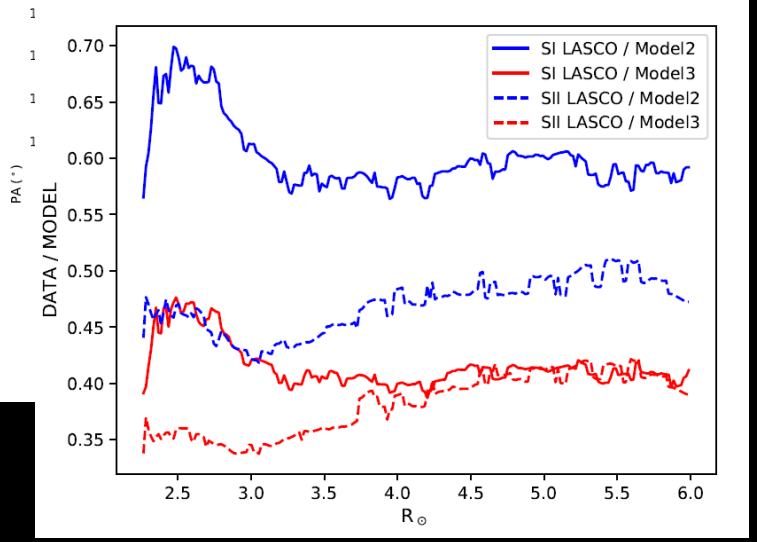
North

Equator

North

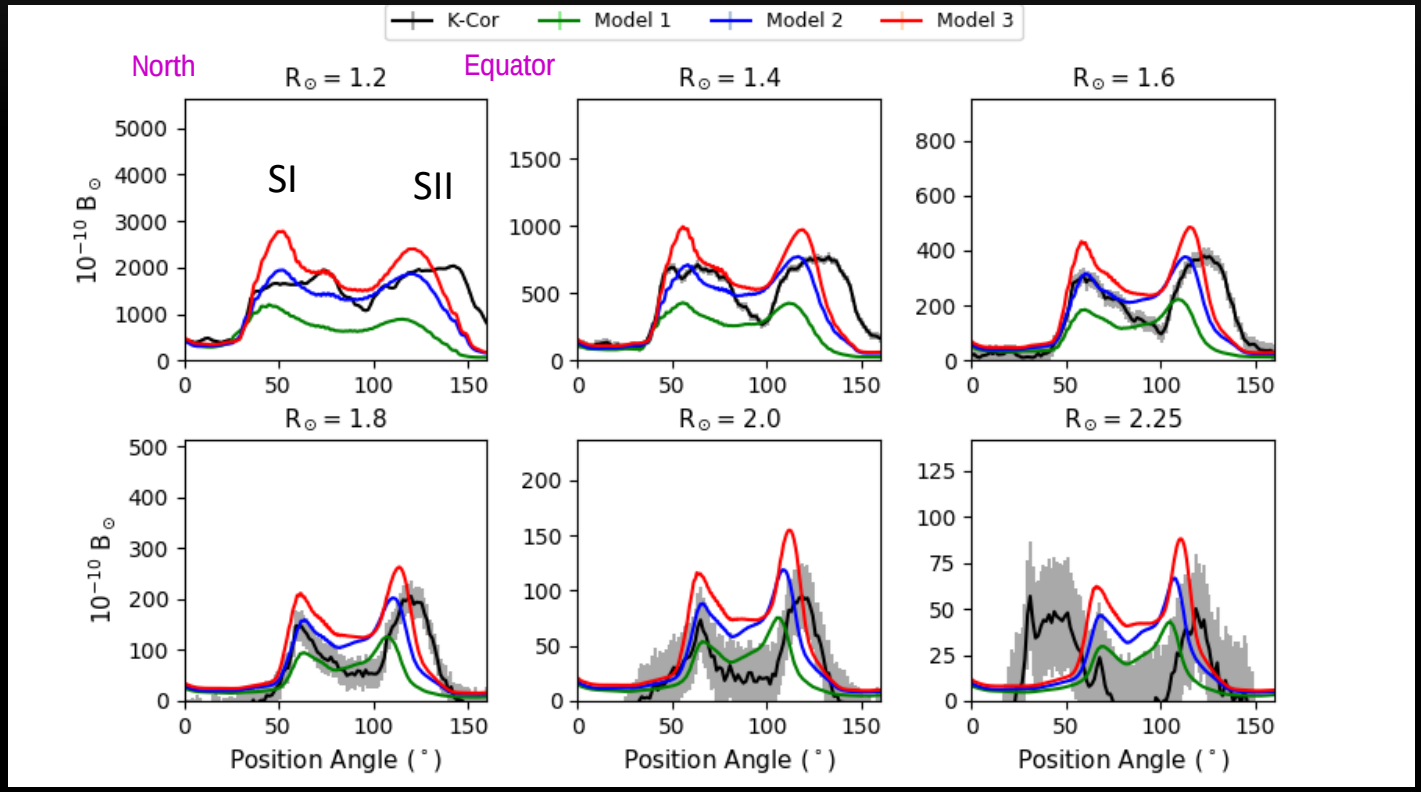






- K-Cor … and 3 … roduced by Model 2
- The s… … too b… ages for LASCO are
- N… … observations at ~2 Ro
- The radial decay is correct

REPRODUCING THE LATITUDINAL INTENSITY PROFILES IN CORONA: K-COR



- S I and S II are simulated very well in amplitude and asymmetry (Model 2)

CONCLUSIONS

- We provide QUANTITATIVE similarities and differences between WindPredict – AW and the observations (AIA, K-Cor, LASCO).
- WindPredict – AW gives consistent results for the quiet corona both in EUV and WL pB.
- Model 2 (in some cases Model 3) best represents the observations.
- Further improvements of the model are ongoing: active corona, TR.
- Example of applications: Solar Orbiter perihelia prediction

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