Total Eclipse on August 12, 2026: observations in Spain and prediction with COCONUT

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Abstract:

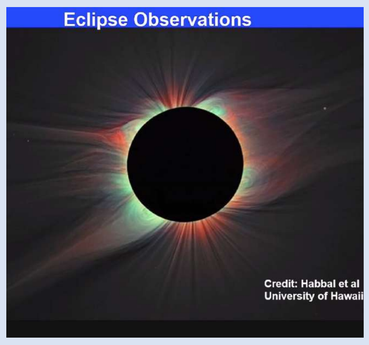
Because of the lack of white light coronagraph observations in the low solar corona (1-1.5 solar radius), total solar eclipses are a standard way of assessing coronal structures and testing coronal models. Total solar eclipses constrain the validation period of coronal modelling, as they occur rarely. However, currently, it is the only way to distinguish features in the low corona near the solar surface. Soon, the PROBA 3 mission will provide continuous observations of the low corona. Total solar eclipses provide a single snapshot of the solar corona, whereas time-dependent simulations require continuous white-light observations.

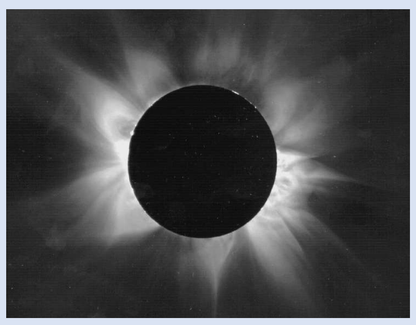
COCONUT was utilised to predict the previous total solar eclipse in April 2024 (Baratashvili et al. 2025, A&A, in press). In the setup demonstrated in the manuscript, a low-resolution, simplified approach is used. However, multiple developments in the COCONUT model since the previous total solar eclipse enable continuous, time-dependent, high-resolution simulations (Wang et al., 2025, in press) for predictions of the upcoming total solar eclipse on August 12, 2026, at 18:27 UT. Additionally, we plan a network of observations in Spain with multiple sites (Santiago de Compostela, Teruel, Valladolid, Riga) to achieve the best possible coverage of the total solar eclipse and capture high-quality images to validate the predictions of the COCONUT model. Synthetic white-light images will be generated from the COCONUT simulations for direct comparison with the observed images.

This way we can use the total solar eclipse on August 12, 2026, to validate the COCONUT model, and identify its strengths and weaknesses.

Observations of the solar corona

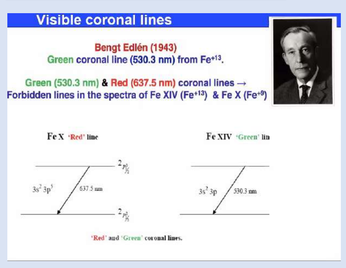
Solar coronal temperature is between 0.8 to 10 million degrees.
Solar corona is observed in Space by satellites like SDO in X ray or in white light with a coronograph (SOHO/LASCO).
On the ground, we can observe the solar corona in the red/green lines in mountain observatories and in White light during eclipses because the corona is too faint in optical radiation range (10^{-6}).

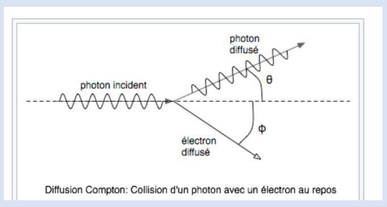




White light

Green and red lines



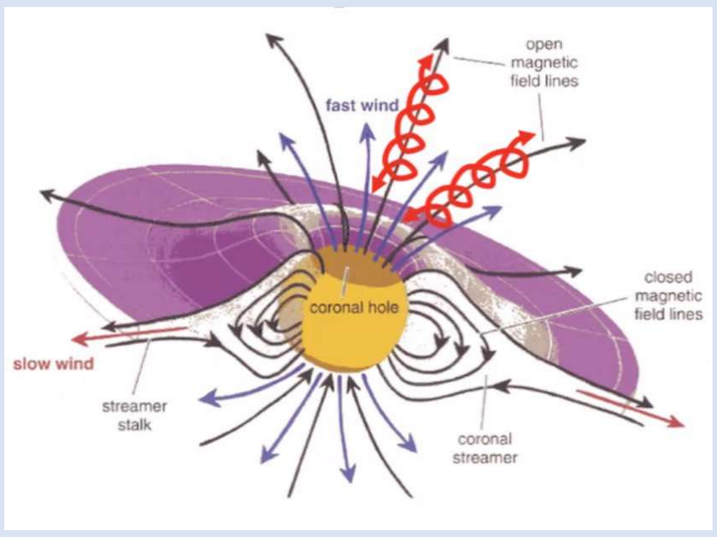


Diffusion Compton: from the photosphere by the electrons of the corona

The corona has a low density;
Not enough e^- for recombination

Morphology of the corona

The morphology of the corona in eclipse depends strongly on the solar cycle phase: at solar maximum the low corona is marked by the active regions which are mainly located between the latitudes 0 and 60 degrees).
In the higher corona it is modulated by the Solar Wind, streamers and pseudo-streamers.

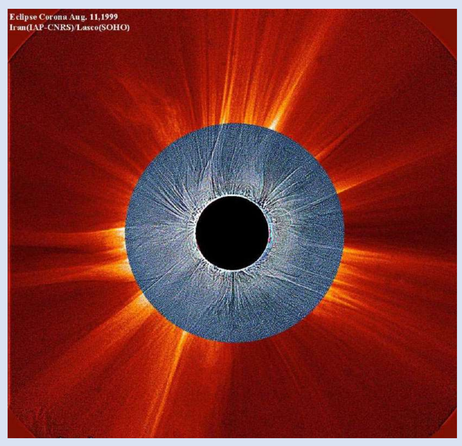


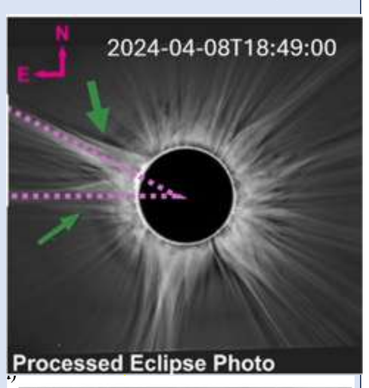
Observations 8 April 2024

Image taken from Dallas, Texas, USA.

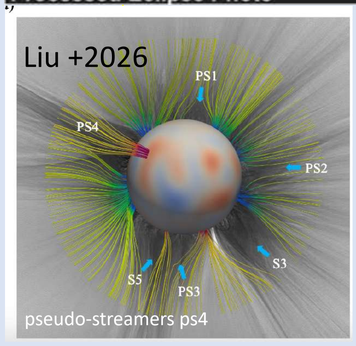
Credit: B.Schmieder (LIRA)

Eclipse 11 August 1999





Combined pictures: eclipse and LASCO



Predictions at PSI

(Downs et al. ApJ 2025)

Input data, assimilation, and modeling of solar photospheric magnetic fields.
HMI magnetograms were assimilated with the SolO/PHI magnetic field observations. The surface flux transport HipFT was used for predicting the global Br maps for the simulations.

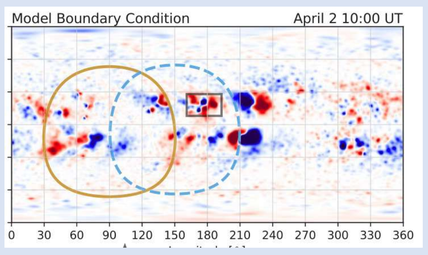


Figure is taken from Downs et al. 2025.

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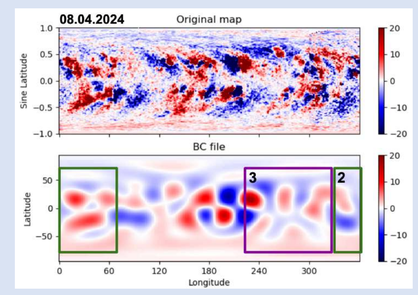
Comparison between the predicted and observed corona during the eclipse.

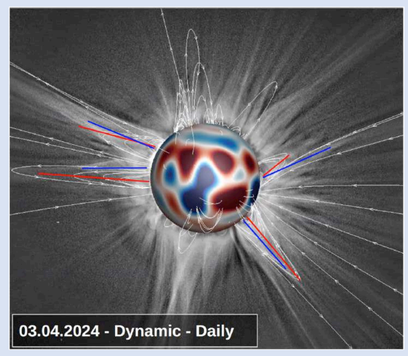
(A) Wavelet sharpened and detrended brightness from the model prediction made at 8 April 2024 9:00 UT.
(B) Composite eclipse photo processed (14) to highlight coronal structures observed during totality.
(C) Same as (A), but after an additional week of data assimilation. The streamer on the northeast limb (green arrows) shifts position between the two predictions, owing to the emergence of several new ARs.

Predictions with COCONUT at KU Leuven

(Baratashvili et al. A&A 2026)

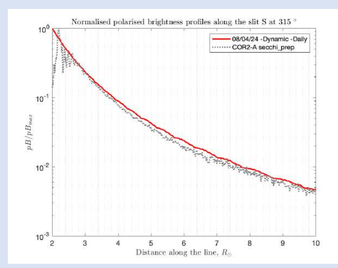
The predictions with the 3D MHD coronal model **COCONUT** started on March 21. The predictions were performed under both steady and dynamic regimes.
GONG magnetograms were used for driving the coronal simulations. The enclosed boxes on the right denote areas that showed variations before the total solar eclipse.



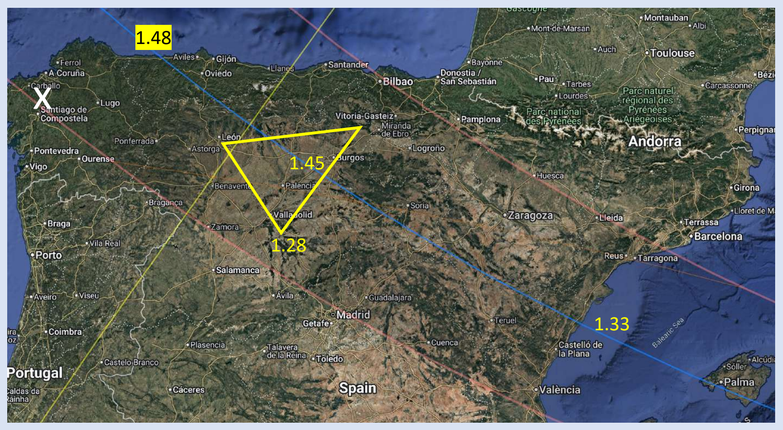


The image of the eclipse is overlaid in the background. The solar surface is colored with the processed radial magnetic field values. The directions of the streamers are compared from the structures in the image to the modelled streamlines in COCONUT.

The normalized polarized brightness along the radial slit at 315° from COCONUT simulation and STEREO A-COR2 data during the total solar eclipse. The observed normalized profile matches well with the modelled one.



Eclipse 12 August 2026



http://xjubier.free.fr/en/site_pages/solar_eclipses/TSE_2026_GoogleMapFull.html?Lat=42.33193&Lng=-3.67130&Elv=936.0&Zoom=6&LC=1

The weather: https://eclipsophile.com/tse2026/

Conclusion:

The path is going from Iceland to Spain.

All the co-authors of the poster belong to a network and will be in contact and exchange the data of the eclipse.

References:
* Baratashvili T., Wang H.P., Sorokina, Lani A., Poedts A&A 2026
* Xianyu Liu ,Weihao Liu, Ward B. Manchester et al ApJ 2026
* Downs C., Linker.J. et al , Science 2025
* Yihua Li, Guoyin Chen, Jin Han Guo + ApJ 2026