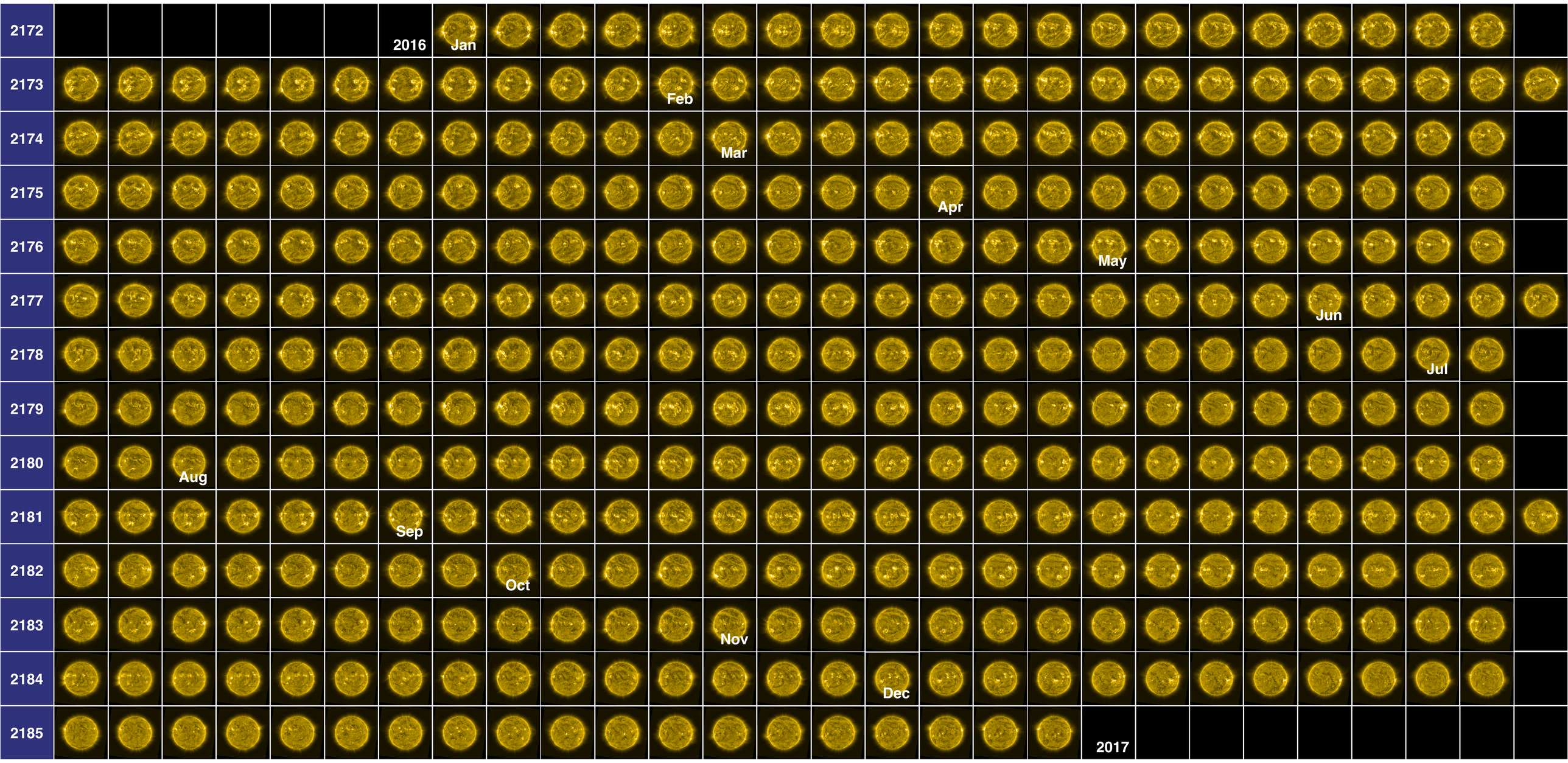
THE EVOLVING SUN THROUGHOUT 2016



Throughout 2016 the Sun's 11-year activity cycle continued towards its minimum, a period when the number of sunspots, active regions, solar flares and eruptions diminish, whereas coronal holes—regions of lower emission seen in the Sun's atmosphere—are larger and more prominent. The changing activity of the Sun was continuously monitored by SWAP—the extreme-ultraviolet imager onboard ESA's PROBA2 satellite—, which is represented in the series of images above, where one image was selected from each day of the mission during 2016.

When observing the Sun for a prolonged period of time, it soon becomes evident that features on its surface, and in its outer atmosphere do not rotate at the same rate. This is because the Sun is not a solid body, but a big ball of magnetised plasma, whose rotation is variable with position and height in the solar atmosphere. A Carrington Rotation is a period of time chosen to represent one rotation of the Sun. A period of 27.28 days was chosen to represent a single rotation that largely resembles the recurrence time of features near the equator. Each rotation of the Sun is assigned a Carrington Rotation Number, starting from 09-Nov-1853. That number reached 2172 on 2015 Dec 25. The above images have been aligned by Carrington rotation (indicated by the number at the beginning of each row), In doing so, we can compare how phenomena has varied from one rotation to the next. In particular we can follow the evolution of active regions (bright regions in the images above) and coronal holes which are seen as regions of reduced emission.

Active regions are areas of complex magnetic activity that can produce solar eruptions and flares. The most active region of 2016 can be seen close to the centre of the Sun on July 17th. This region created 8 of the 20 most powerful flares observed in 2016, including the most energetic, an M7.6 class flare on July 23rd. Coronal holes produce streams of fast solar wind which can cause geomagnetic storms on Earth. One of the largest holes can be seen in the North on the 24th of November. This region was observed for several solar rotations and caused recurring geomagnetic disturbances.

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