PRESS RELEASE

Switchbacks: Could Solar Jets Hold the Key?

Paris, December 4 2024,

NASA's Parker Solar Probe mission has detected magnetic distortions in solar wind, known as switchbacks. To better understand these phenomena, whose origins remain uncertain, a study was conducted by a network of collaborators including the Laboratory for Plasma Physics *(LPP – Sorbonne University / École Polytechnique / Institut Polytechnique de Paris / Observatoire de Paris-PSL / CNRS)*, the Laboratory for Physics and Chemistry of the Environment and Space *(LPC2E – Observatoire des Sciences de l'Univers / University of Orléans / CNRS / CNES),* the French-Spanish Laboratory for Astrophysics in Canarias (*FSLAC ; CNRS/Instituto de Astrofísica de Canarias*) and several UK researchers. This groundbreaking study, published in the journal Astronomy & Astrophysics, reveals that solar jets can create similar disturbances without causing a complete reversal of the magnetic field.

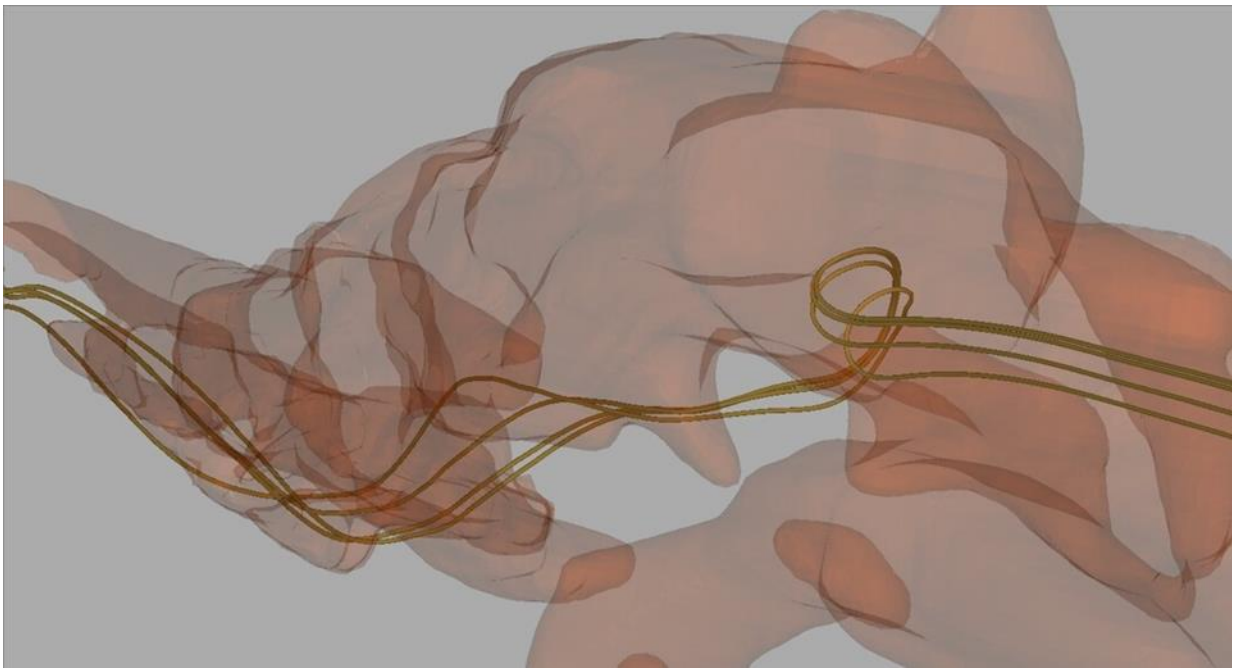

Illustration of magnetic field line distortion in a solar jet
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NASA's Parker Solar Probe mission revealed the presence of switchbacks, sudden and rapid reversals of the magnetic field in the solar wind. These peculiar phenomena, rarely observed near Earth, have captivated the scientific community due to their enigmatic origins. A leading theory suggests that switchbacks originate from solar jets, which are ubiquitous in the lower atmosphere of the Sun.

To investigate their origins, a team of researchers from LPP[1], LPC2E[2], FSLAC[3], the University of Dundee and Durham University[4] conducted 3D numerical simulations to replicate plasma behavior in the Sun's atmosphere. These simulations modeled solar jets and studied their propagation in solar wind. By adjusting parameters such as pressure, temperature, and magnetic field strength, the researchers recreated the diversity of solar atmospheres observed. They then analyzed the simulation data in a manner similar to the instruments aboard the Parker Solar Probe, identifying magnetic field distortions reminiscent of switchbacks.

Their findings reveal that solar jets can produce magnetic distortions similar to switchbacks, although complete magnetic field reversals were not observed. This suggests that additional solar atmospheric phenomena, interacting with solar jets, may be responsible for switchbacks with total magnetic field reversals. These results encourage further research to unravel these complex mechanisms.

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[3] French-Spanish Laboratory for Astrophysics in Canarias (FSLAC ; CNRS/Instituto de Astrofísica de Canarias)

[4] School of Mathematics, University of Dundee, & Durham University, Department of Mathematical Sciences.

Learn more:

- J. Touresse, E. Pariat, C. Froment, V. Aslanyan, P. F. Wyper and L. Seyfritz ; "Propagation of untwisting solar jets from the low-beta corona into the super-Alfvénic wind: Testing a solar origin scenario for switchbacks." ; Astronomy & Astrophysics

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