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Automated method for 3D tracking of coronal mass ejections

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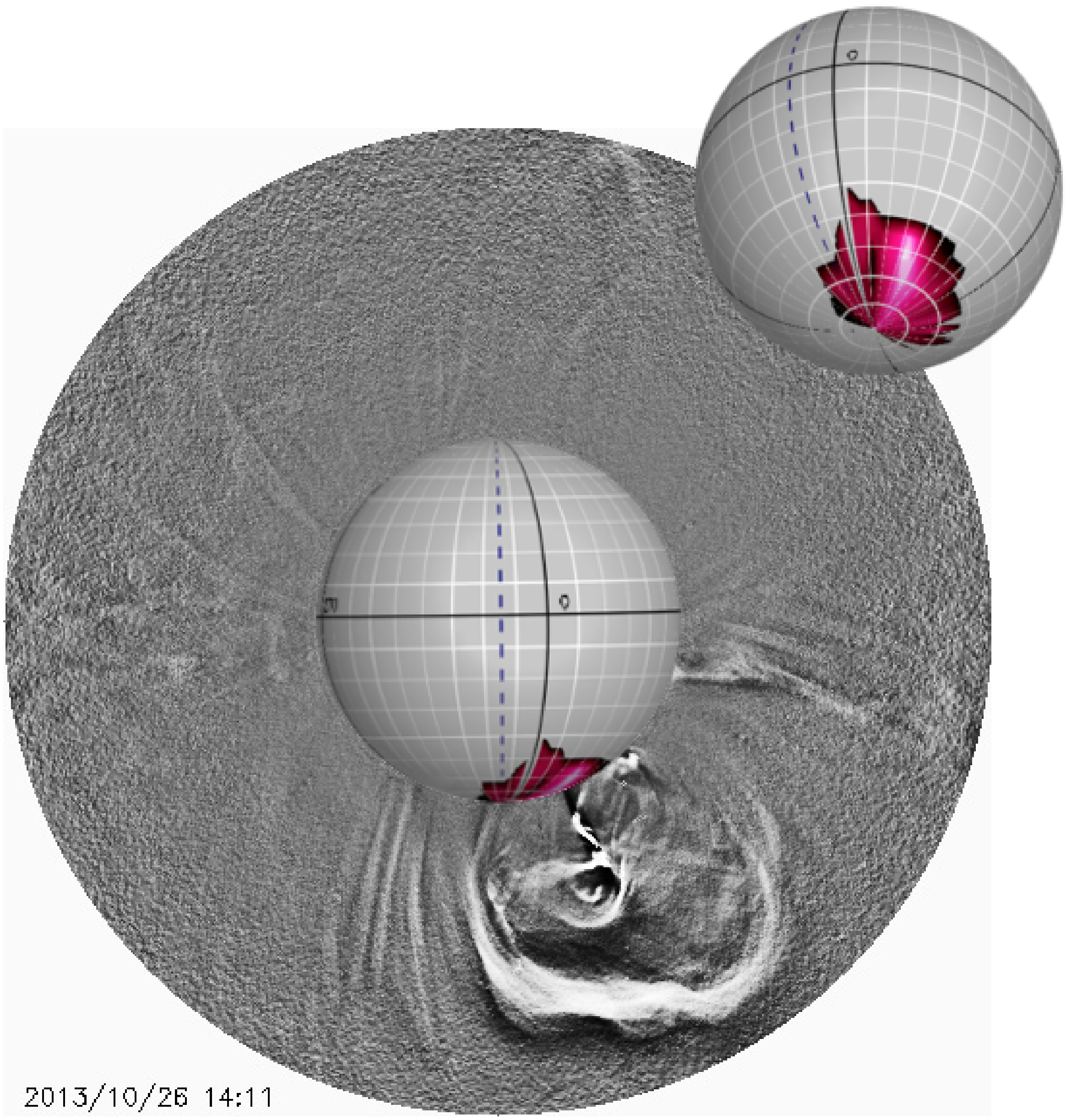

A sample result produced from the ACT method. It shows an image of a CME as seen by the SOHO-LASCO-C2 coronagraph. The result of the 3D detection is set into the centre and shows the region through which the CME passed. This is then wrapped onto a sphere and aligned with the coronagraph's position and orientation. The sphere in the top corner is the same result, orientated to better show the region of interest. Credit: ESA/NASA/SOHO/LASCO

Scientists at Aberystwyth University have developed an automated method for three-dimensional tracking of massive eruptions from the sun, called coronal mass ejections (CMEs). The Automated CME Triangulation (ACT) system uses data from three space-based observatories that orbit the sun at different locations, allowing scientists to view the sun and CMEs from different angles. ACT's ability to track whether a CME is heading towards Earth, and when it is likely to reach us, should lead to significant improvements in space weather forecasting. ACT will be presented at the National Astronomy Meeting 2016 in Nottingham by Joe Hutton on Wednesday 29th June.

During CMEs, billions of tonnes of solar material are thrown out into interplanetary space at speeds of up to 2500 kilometres per second. If directed at Earth, these eruptions can cause extensive and expensive disruption by damaging power, satellite and communication networks.

"All current CME tracking services rely on flat images from only one coronagraph to estimate the speed and acceleration of the eruption," said Hutton. "Predictions are based on the hugely inaccurate assumption that the CME is always travelling at a right-angle to the observation, when it could actually be propagating in any direction."

ACT works by bringing together data from coronagraph instruments on

SOHO and the twin STEREO spacecraft. By isolating the CME signals in the data captured by the three coronagraphs, ACT is able to triangulate the position of a CME and determine the most likely region through which it passed at a given height above the sun. The centre of this region gives the most likely direction that the CME will propagate in three-dimensions, as well as a reliable estimate for the size of the eruption.

"Using ACT, scientists can use the direction of CME travel to calculate true values for the velocity and acceleration of the eruption. They can also make accurate calculations for the total mass the of solar material that makes up the CME. By knowing the velocity and mass of the eruption we can gauge the impact the CME could have if it were to collide with the Earth," said Hutton.

Provided by Royal Astronomical Society

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