Researchers statistically analyze small-scale magnetic reconnections

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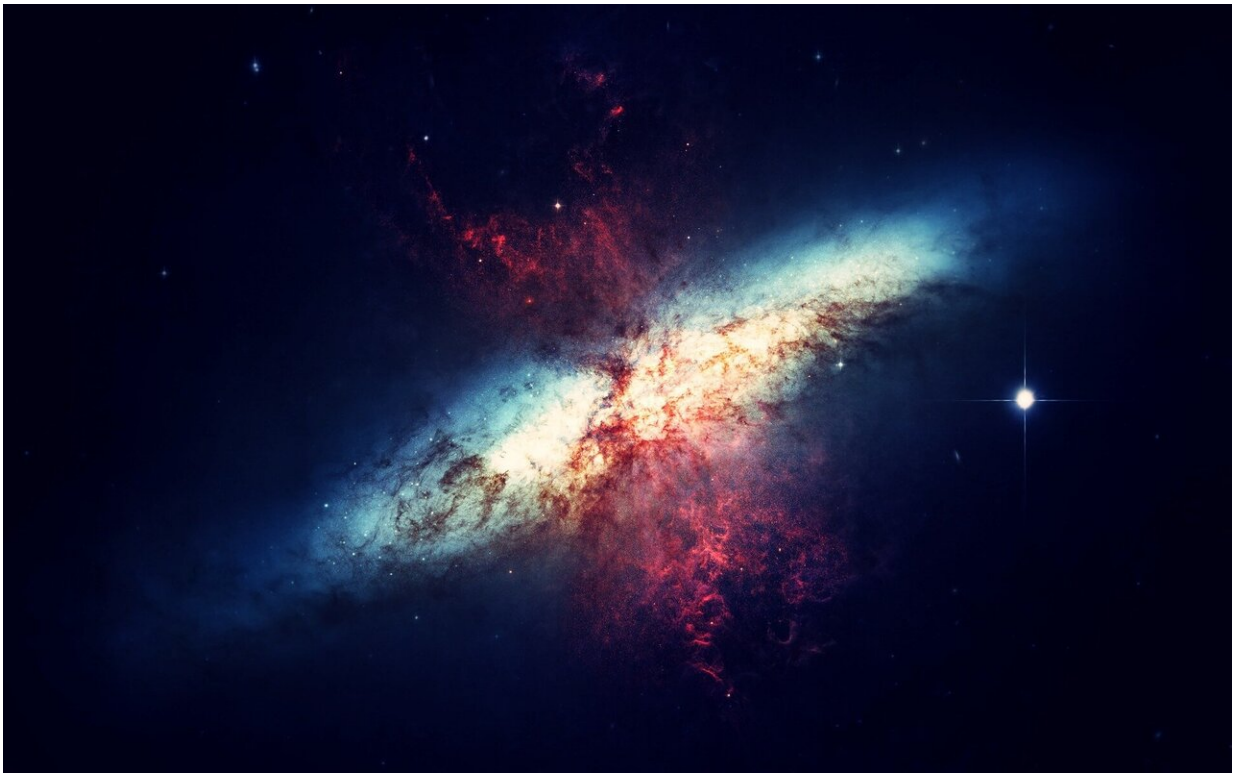

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Dr. Xue Zhike's group from Yunnan Observatories of the Chinese Academy of Sciences statistically studied six small-scale magnetic reconnections for the first time using the high-resolution data obtained by the 1-meter New Vacuum Solar Telescope (NVST) at the Fuxian

Solar Observatory of Yunnan Observatories. The findings were published in *The Astrophysical Journal*.

Magnetic reconnection plays a crucial role in determining the topology of magnetic fields in cosmic plasma, and provides an efficient way for the conversion of magnetic energy into kinetic energy. Magnetic reconnection is not easy to observe and confirm, even though it is generally considered to be directly related to the solar eruptions. Previous observational reports on magnetic reconnection are often based on a single event.

In this study, the researchers carefully checked the high-resolution data of the NVST from 2012 to 2020, and found only six cases of magnetic reconnection with obvious inflows and outflows.

All of these magnetic reconnections have large separatrix angles. Their morphological characteristics and magnetic field configurations were obtained by the NVST and the Solar Dynamics Observatory (SDO). Meanwhile, several physical parameters of each magnetic reconnection were calculated including the velocities of reconnection inflows, outflows, and separatrix jets, the angles between each pair of separatrices, and the width and length of current sheets and their ratio.

The researchers found that the outflow velocity, the separatrix jet velocity, and the width and length of the current sheet are positively related to the inflow velocity, however, the separatrix angle does not depend on the inflow velocity and is related to the initial magnetic field configuration before magnetic reconnection.

Besides the inflow velocity, they found that the magnetic diffusivity or the magnetic Reynolds number is also important to determine the width of the current sheet.

The magnetic reconnection rates are different among the six reconnection events, and decreases with the increase of the inflow velocity. The results obtained by the kinetic parameters and by the parameters of the current sheet are consistent. Meanwhile, when the separatrix angle is close to 90°, the jet and the outflow reach their maximum velocities.

The findings of these observations are consistent with the results of theoretical model and numerical simulation. In the future, the researchers need to observe finer structures and more accurate magnetic fields to find out how the magnetic reconnection is triggered and to improve the understanding of magnetic reconnection.

More information: Z. K. Xue et al, Observations of Magnetic Reconnection with Large Separatrix Angles and Separatrix Jets above the Solar Surface, *The Astrophysical Journal* (2021). DOI: 10.3847/1538-4357/abfb71

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