Collisions of coronal mass ejections can be super-elastic

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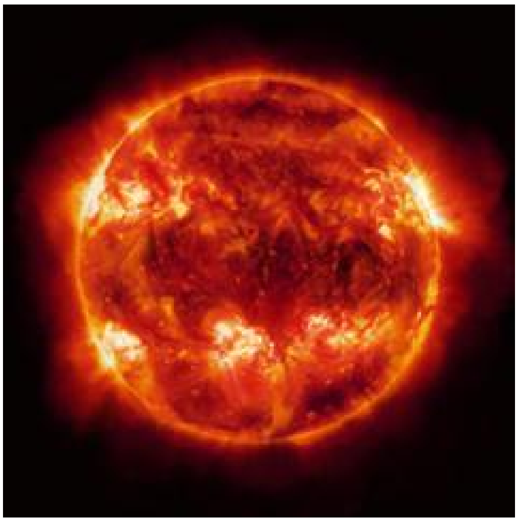

Coronal mass ejections (CMEs), emissions of magnetized ionized gas from the Sun, can damage satellites and communication technology, so being able to predict where they are heading and how much energy they have is important in protecting this technology.

Sometimes two CMEs collide and bounce off each other like elastic balls, changing their directions and speeds. It has been suggested that in some cases the collisions can even be super-elastic, which means that the total kinetic energy of the two colliding CMEs actually increases after the collision as some of the thermal or magnetic energy in the CMEs is converted to kinetic energy. However, the super-elastic nature of these collisions had not been confirmed until now.

Shen et al. conducted three-dimensional magnetohydrodynamic simulations based on an observed collision of two CMEs in 2008. They compared a simulated non-collision case with a simulated collision case and find that the collision between CMEs does undergo a super-elastic process. The kinetic energy gained in the collision was about 3 to 4 percent, which closely matches observations. The study confirms that CME collisions can be super-elastic.

More information: "Could the collision of CMEs in the heliosphere be super-elastic? Validation through three-dimensional simulations" *Geophysical Research Letters*, doi:10.1002/grl.50336, 2013. onlinelibrary.wiley.com/doi/10 … 2/grl.50336/abstract

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