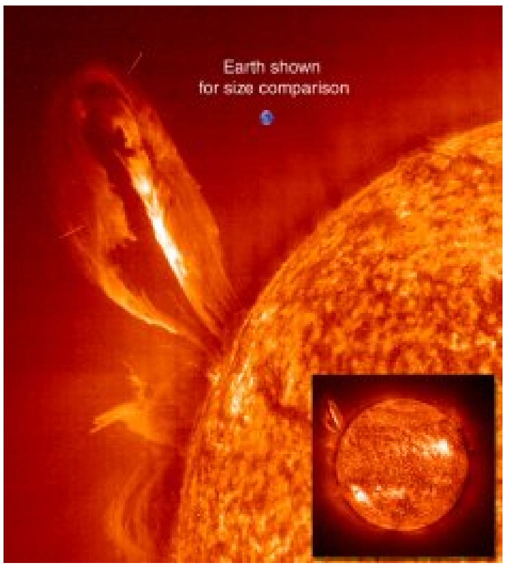
How space eruptions happen

April 7 2009



The picture of a space eruption has been taken by the EIT instrument on the SOHO spacecraft. Courtesy of SOHO/EIT consortium. SOHO is a project of international cooperation between ESA and NASA

(PhysOrg.com) -- Mathematicians at the University of St Andrews have made a discovery which could lead to a better understanding of why huge eruptions occur in space.

The team has found new models of small structures in space plasmas, called "current sheets", which could help explain how explosions in the solar atmosphere happen.

Dr Thomas Neukirch, a Reader in Applied Mathematics at the School of

Mathematics and Statistics explained the phenomenon.

He said, "Plasmas are gases or fluids that are able to conduct electric currents. While in our direct environment plasmas are rare (apart from technical applications such as neon lights or plasma TV screens), in space most matter is in the plasma state."

Solar scientists have shown that the enormous energies needed for eruptions come from the interaction of the plasma with magnetic fields.

Dr Neukirch continued, "One can imagine magnetic fields as a collection of elastic strings, and like elastic strings they can be stretched and twisted, thus storing energy. And just like elastic strings, magnetic fields can tear if overstretched and release the stored energy, thus leading to an eruption.

"A major difference between magnetic fields and elastic strings is that magnetic field lines cannot have loose ends as strings can. When magnetic fields tear apart every field line has to find a partner to which it reconnects. This process is therefore called magnetic reconnection."

According to the researchers, observations clearly show that magnetic reconnection is happening, for example, on the Sun, yet this has surprised experts as the usual conditions in most space plasmas should not allow it to happen.

Dr Neukirch said, "Scientists believe that the solution to this puzzle is that during the twisting and stretching of the magnetic field very small regions of plasma form which carry large electric currents - so-called current sheets.

"The conditions in these current sheets are much more favourable for magnetic reconnection to happen and therefore understanding current sheets is crucial for understanding how large eruptions can happen."

In the solar atmosphere and in many other space plasmas the electric currents should flow along the magnetic field, but in the most widely used current sheet model this is not the case.

The new models have extended the possibilities to understand the energy release process and may therefore lead to major advances in our understanding of magnetic reconnection in space plasmas.

Provided by University of St Andrews

Citation: How space eruptions happen (2009, April 7) retrieved 25 April 2024 from https://phys.org/news/2009-04-space-eruptions.html