Physicists Trash Turbulence Lab

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Researchers at the University of Warwick have trashed the world's biggest turbulence lab by turning a pleasant stream into a raging torrent - but they say their actions will lead new understandings in one of the main unsolved problems in physics - turbulence.

Turbulence is one of the main unsolved problems in physics. Turbulent systems fluctuate wildly and understanding this will also help us understand (and put a number on the likelihood of) extreme events in other systems that look the same in terms of the mathematics, such as the weather, and stock market prices.

It is technically very challenging to study turbulence on earth, either in the laboratory or on even the largest computers that are available. A very large experiment is needed, and so researchers have turned to space to use the whole solar system as a turbulence laboratory. The solar system is filled by the sun's expanding atmosphere - the solar wind, we see its effects directly here on earth as "space weather" (the northern lights). The solar wind also effects how cosmic rays reach the earth, which may have important consequences for earth weather and climate change.

A familiar example of turbulence is a stream flowing over a weir. A trick often used to study this is to follow a "passive scalar" - an element of the flow that follows the flow but does not cause or suffer significant change. In the case of a stream a passive scalar might be a leaf floating downstream. In the case of the solar wind it was hoped that the density of the wind is passive, allowing researchers to use a relatively simple set of mathematical tools to model the turbulence.

However new results about to appear in Physics Review Letters by researchers at the University of Warwick has shown that the density in the solar wind behaves less like a leaf in a stream and more like a pile of enormous boulders and tree trunks being smashed along a raging torrent of water.

The research by Dr Bogdan Hnat, Professor Sandra Chapman, and Professor George Rowlands at The University of Warwick's Department of Physics, and which drew on data from the NASA ACE satellite indicates that turbulence scientists will have to abandon using the density of the solar wind as their "passive scalar" leaf and seek more complex solutions to their problems.

Source: University of Warwick

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