40 year old Mariner 5 solar wind problem finds answer - turbulence doesn't go with the flow

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(PhysOrg.com) -- Research led by astrophysicists at the University of Warwick has resolved a 40 year old problem with observations of turbulence in the solar wind first made by the probe Mariner Five. The research resolves an issue with what is by far the largest and most interesting natural turbulence lab accessible to researchers today.

Our current understanding tells us that turbulence in the solar wind should not be affected by the speed and direction of travel of that solar wind. However when the first space probes attempted to measure that turbulence they found their observations didn't quite match that physical law. The first such data to be analysed from Mariner 5 in 1971 found a small but nonetheless irritatingly clear pattern in the turbulence perpendicular to both the direction of the travel and the magnetic field the solar wind was travelling through.

While it was an irritating aberration the affect was relatively small and has been essentially ignored by physicists until now. However the most recent space missions to look at the solar wind, such as the Cluster mission, are examining it with such sensitive and highly accurate modern instrumentation that what was once a small aberration was threatening to become a significant stumbling block to us getting a deeper understanding of what is going on in the solar wind – which is effectively the solar system's largest and most interesting natural turbulence lab.

Research led by Andrew Turner and Professor Sandra Chapman in Centre for Fusion, Space and Astrophysics at the University of Warwick has found a solution to this 40 year old problem. The research team looked at data from the Cluster mission and they also created a virtual model of how magnetohydrodynamic (MHD) turbulence builds up in the Solar wind. They then flew a virtual space probe through that virtual model in a range of directions unlike the single direction of travel open to a probe such as Mariner 5.

University of Warwick researcher Andrew Turner said that what they found was that:

“The analysis clearly showed that when all these results were considered together any correlation between changes in the turbulence in the solar wind and the direction of travel simply disappeared. The observed non-axisymmetric anisotropy may simply arise as a sampling effect of using just one probe taking a single particular path through the solar wind.”

More information: The research paper, entitled "Non-axisymmetric Anisotropy of Solar Wind Turbulence," is published in *PRL* and is by A.J. Turner, S. Chapman B. Hnat Centre for Fusion, Space and Astrophysics, University of Warwick; G. Gogoberidze, Centre for Fusion, Space and Astrophysics, University of Warwick and the Institute of Theoretical Physics, Ilia State University; and W.C.Müller of the Max-Planck-Institut für Plasmaphysik.

Provided by University of Warwick