Physicists suggest theory versus observational differences in the sun could be due to dark matter

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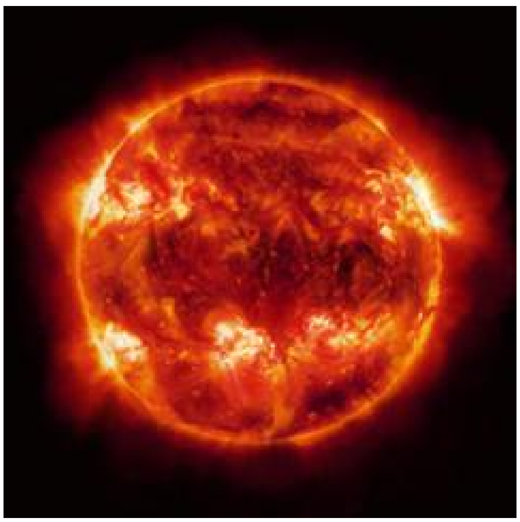

A trio of astrophysicists has found that differences between observational data and solutions brought about through mathematics regarding the mechanism involved in heat transfer from the suns center to its outer parts, can be resolved by plugging dark matter into equations. In their paper to be published in *Physical Review Letters,* Aaron Vincent and Pat Scott, both in the UK and Aldo Serenelli in Spain, describe how they developed several models to show how dark matter might impact heat transfer in the sun and what they found by doing so.

As observational technology has improved, scientists have learned more and more about the sun, but that has led to another problem—sometimes the observations do not match with theory or models that have been built to explain how the sun works. One example, has been work done using helioseismology, where pressure waves are studied—such work has led to observations of how heat is transferred in the sun that differ from theory. In this new work, the researchers suggest the difference might be explained by interactions with dark matter.

Dark matter, has of course, not been proven to exist, but evidence has piled up for the existence of some sort or matter that we cannot see or truly explain. To find out if it might be at play in the sun (captured perhaps by its gravity) the team built four models. One of the models was based on standard theory, the other three all took into account the possible impact of dark matter. The dark matter models mathematically described the possibility of interactions between dark matter and regular matter and the momentum that might or might not occur. In studying their models, they found that one, which was based on a momentum-dependent interaction cross-section, fit with observational data, if the mass of the dark matter particle was set at 3 GeV. None of the other models fit in any way. In that model, dark matter carried a significant amount of heat from the sun's core to the outer solar layers, offering an explanation of prior differences with observational data.

The team plans to continue work on their models, and express hope that as they do so, workers at the LHC or those in underground facilities will finally capture evidence of the mysterious dark matter, adding considerable credence to their findings.

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More information: *Phys. Rev. Lett.* 114, 081302 (2015) physics.aps.org/synopsis-for/1 … ysRevLett.114.081302 preprint availabe at: arxiv.org/abs/1411.6626