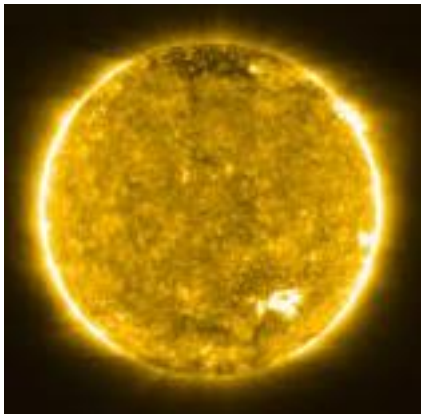
Structure and evolution of the solar wind



The Sun in UV light, taken by the Solar Orbiter at 0.5 AU: Solar activity is driven by the tangled solar magnetic field. Image: EUI Consortium.

PhD project
Space, Plasma, and Climate Community
October 2025 start, full-time.

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The Sun's solar wind is a prototype for stellar winds, as well as being the driver of "space weather" which can dramatically affect our lives on Earth. It is also an excellent laboratory for collisionless plasma processes, such as shocks and turbulence, which occur throughout the Universe. We are in an unprecedented era of exploration of the solar wind near the Sun, with NASA's Parker Solar Probe making encounters through the Sun's upper atmosphere, and ESA's Solar Orbiter rising to high latitudes to enable us to measure how different regions on the Sun produce solar winds. We have a major involvement in both missions – we built the magnetic field instrument for Solar Orbiter – and you will join a lively science team in the group studying solar wind science.

By the time this project starts, Parker will have entered its key science phase having reached its closest perihelion under 10 solar radii, and Solar Orbiter will be beginning its journey to higher latitudes. In this project you will use data from both missions to study the large-scale structure of the solar wind and how it relates to the evolving global solar magnetic field, which is key to understanding its dynamo and the 11-year solar cycle of activity. It will involve the analysis of multiple data sets from spacecraft, so some programming ability is essential and there is the opportunity to use machine learning and to undertake complementary theoretical analysis. You will be expected to join the energetic worldwide solar wind science community and will have the opportunity to travel to meetings in Europe and the US.

Solar Orbiter also travels upstream of the Earth where it acts as a monitor for incoming space weather events and in combination with NASA's IMAP mission (launching in July 2025) for which we also built the magnetic field instrument, you can also make a significant contribution to the forecasting of major space weather events at the Earth.

NASA's IMAP spacecraft s getting ready for launch in July 2025, carrying one of our magnetometers. Image: NASA/APL

This is an exciting opportunity to be part of the discovery phase of some of the most exciting space missions for many years. You will work alongside other PhD students, postdocs and academic staff in our solar wind team here at Imperial and collaborate extensively with the worldwide communities of both missions. You will also have the chance to interact with the engineering team who build and operate our instruments.

You will need some programming skills; a knowledge of plasma physics would be an advantage. Please email me (t.horbury@imperial.ac.uk) if you have any questions.