Christopher Manser

Imperial College London

White dwarfs as astrophysical probes: From planetary systems to magnetic fields

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White dwarfs are the stellar end-point for the majority of the stars in the universe. As they no longer undergo nuclear burning, they mostly slowly cool over time. These systems are important for nearly all aspects of astrophysics, existing in the progenitors of type-1a supernovae, being the future host stars for the vast majority of known exo-planetary systems (in addition to our own!), and allowing us to study complicated physics in detail such as accretion disc structure and evolution, as well as understanding magnetic fields extending up to 1000 MG.

In this talk I will discuss two aspects of my recent work with white dwarfs. The first will be focusing on observations of planetary systems that have survived the evolution of their host star into the white dwarf phase. Unfortunate planetary bodies that pass close (~1 solar radius) to the white dwarf will be tidally disrupted and form a compact accretion disc feeding the white dwarf. Fortunately for us however, these "polluted white dwarfs" allow us to uniquely probe the bulk-abundances of exo-planetary bodies, but our understanding of how this material is accreted by the white dwarf is relatively poor. I have generated velocity-images of two white dwarf gaseous debris discs using the method of Doppler tomography, which I will go through and show how these images could be used to probe the temperature and density structure of these discs. Secondly, I have been working with the Dark Energy Spectroscopic Instrument (DESI) collaboration, which is producing a survey of 10s of millions of astronomical objects. During this survey over 66,000 white dwarfs will be observed, and I will show some results focusing on a rare subset of magnetic white dwarfs that show hotspots generating emission from their magnetic poles, and how we have used DESI and archival-SDSS spectroscopy to provide an eight-fold increase in the number of these rare systems known.