An ultra-irradiated likely brown dwarf orbiting a white dwarf

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Intense ultraviolet radiation plays an important role in a variety of astrophysical environments, from star-forming molecular gas clouds, through protoplanetary discs, to planetary atmospheres. This extreme radiation, that might lead to gas evaporation and to complete molecular dissociation, can significantly affect both stellar and planetary evolution. Irradiated substellar objects in very close orbits around hot and massive stars probe planetary atmospheres in this extreme and largely unexplored regime. However, their small sizes compared to their host stars greatly limit our ability to detect and study these systems. Irradiated substellar objects can be particularly revealing when they are in tight orbits around hot white dwarf stars (as opposed to massive normal stars), where the small size of the white dwarf permits even closer companion orbits and hence similar or even higher irradiation of the companion by the host. In such systems, light from the companion's day- and night-side atmospheres can be detected and studied directly, as the low luminosity of the white dwarf does not overwhelm that of the companion, and the spectrum of each component peaks in different wavelength bands (ultraviolet and infrared). Brown dwarfs irradiated by white dwarfs can thus serve as useful hot Jupiter analogues.

In this talk I will present the discovery of an extremely irradiated low-mass companion to a hot white dwarf. Our analysis indicates a companion mass of $\approx 72 - 85$ Jupiter masses, making it a likely brown dwarf with a day-side temperature similar to the Sun's surface, $\approx 6,000\,\mathrm{K}$, and a day-to-night temperature difference of $\approx 3,000\,\mathrm{K}$.