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White dwarf constraints on CHAMPs

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White dwarfs (WD) effectively act as high-gain amplifiers for relatively small energy deposits within their volume via their instability to thermal runaway that culminates in a supernova. I will detail how a contamination of WD by $\mathcal{O}(1)$-charged massive particles (CHAMPs) could trigger the instability, leading to the destruction of old WD. Such a CHAMP contamination can either be present already in the WD-progenitor, or be accumulated onto the WD over its lifetime. The dense core structure formed at the centre of the WD when the heavy CHAMPs sink can either cause density-enhanced (pycnonuclear) fusion of carbon nuclei dragged into the core by the CHAMPs, or can lead to the formation of a mini black hole (BH) inside the WD. In the latter scenario, Hawking radiation from the BH can heat material and ignite the star if the BH forms with a sufficiently small mass; on the other hand, if the BH forms at large enough mass, acceleration of carbon nuclei that accrete onto the BH as it grows in size may be able to achieve the same outcome (with the conservative alternative being simply that the WD is devoured by the BH). These mechanisms collectively guarantee the destruction of old WD if a sufficient galactic CHAMP abundance is present. Using the known existence of a number of old, massive WD, I will present stringent galactic CHAMP abundance constraints that are up to many orders of magnitude stronger than existing limits in the regime of large CHAMP mass, $m_X \sim 10^{11} - 10^{17}$GeV. I will additionally offer some speculations that, in certain regions of parameter space, this setup might be able to provide a mechanism to explain the calcium-rich gap transients, a class of anomalous, sub-luminous Type Ia-like supernova events that are observed to occur far outside of a host galaxy.

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