Too small to last: the tiniest white dwarf and other stories

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The coalescence of two white dwarfs is thought to be at the origin of type Ia supernovae, if the total mass is high enough, or to result in a massive, highly magnetized, and rapidly rotating white dwarf. Finding a population of white dwarf merger remnants just below the Chandrasekhar mass can help constrain the number of mergers in the Galaxy and their contribution to the type Ia rate. Additionally, it can help us understand the origin of strong magnetic fields in white dwarfs and the peculiar evolution of merger remnants.

In my talk, I will present some early results of the search we are undertaking with the Zwicky Transient Facility for massive, magnetic white dwarfs with periods as short as a few minutes to build a large sample of 'bona-fide' white dwarf merger remnants. During this search, we discovered an extremely peculiar white dwarf, ZTF J1901+1458, with a rotation period of just 7 minutes, one of the shortest measured for an isolated white dwarf, and a magnetic field of almost a billion Gauss, one of the highest fields ever detected on a white dwarf. Additionally, ZTF J1901+1458 has an extremely small radius, just the size of the moon, and therefore a mass that is the closest ever detected to the maximum mass for a white dwarf. In fact, we find that as the white dwarf cools and its composition stratifies, it may become unstable and collapse due to electron capture, exploding into a thermonuclear supernova or collapsing into a neutron star.