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Type Ia supernovae from sub-Chandrasekhar-mass white dwarf detonations: The importance of non-LTE

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The double detonation scenario has recently risen to the forefront of Type Ia supernova (SN Ia) progenitor research. In this channel, a helium-burning detonation on the surface of a sub-Chandrasekhar-mass white dwarf (WD) ignites a secondary carbon-burning core detonation. This scenario has been studied for decades, but it is only in the past year that, for the first time, explosion models with accurate detonation physics and nucleosynthesis have been combined with non-LTE radiation transport calculations, yielding the best match in the literature to the Phillips relation, which forms the basis for the use of SNe Ia as cosmological distance indicators. In this talk, I will describe these improvements and present our generated observables. The success of this scenario in matching observations, as well as other achievements that I will discuss, provide evidence that the double detonation scenario is the mechanism responsible for most SNe Ia.

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