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New Regimes for Thermonuclear Supernovae

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Powering celestial events with radioactive decays of freshly minted elements has been understood for over 30 years now, with the Type Ia supernovae being the most observed event. I will start by reviewing the diversity of the presently known Type Ia supernovae population and its dependence on the type of host galaxy. However, most of my talk will present our (Bildsten, Shen, Weinberg and Nelemans 2007, ApJ, 662, L95) work on a new kind of thermonuclear supernovae from AM Canum Venaticorum binaries. Helium that accretes onto the C/O white dwarf in these binaries undergoes one large flash that is violent enough to create (and eject) 0.02-0.1 solar masses of radioactive 56Ni, 52Fe and 48Cr. This powers a faint and rapidly rising (few days) thermonuclear supernova every 5,000-15,000 years in a typical elliptical galaxy (about 2-6 % of the Type Ia supernovae rate). These ".Ia" supernovae (one-tenth as bright for one-tenth the time as a Type Ia supernovae) are excellent targets for all upcoming celestial survey, yielding between 1 (Pan-STARRS-1) and 30 (LSST) .Ia supernovae per month. Finding and studying these events would allow for the first concrete link between a binary scenario and a thermonuclear supernova.