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Fizzlers

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Type II Supernovae are produced by the collapse of the cores of massive stars at the ends of their nuclear lifetimes. The basic picture for the outburst mechanism of Type II Supernova explosions is rather secure with only the details of the shock generation and the outburst uncertain. *However, broad issues remain concerning our understanding of Type II Supernovae when the less studied, but more general case of rotating and/or magnetic progenitor stars is considered.* That rotation and magnetic fields may play large roles in core collapse has been suggested for almost 40 years dating from the discovery that pulsars, the remnants of Type II Supernovae, are strongly magnetic, rapidly rotating neutron stars. This fact has been further reinforced by the discovery of the class of neutron stars with ultra-strong magnetic fields known as *Magnetars.* The role that rotation plays in core collapse can be appreciated by noting that stable, stationary, degenerate equilibrium configurations are possible only for stars with central density $\rho_c \approx 10^4$-10^9 g cm^{-3} (white dwarf densities) and $\rho_c \approx 10^{14} - 10^{15}$ g cm^{-3} (neutron star densities). Nonrotating objects with ρ_c between that of white dwarfs (typical of the densities of the precollapse cores of Type II Supernovae) and neutron stars are unstable to radial collapse because of the low effective Γ of their equations-of-state (EOS) (see Shapiro & & Teukolsky 1983). Stars at intermediate ρ_c may be stabilized against collapse by rapid rotation. This possibility gives rise to what were coined *fizzlers* by Gold (1974) to describe *fizzled* core collapses of massive rotating stars through formation of rotation-supported stars with densities intermediate between those of the white dwarf-like precollapse core and a neutron star. Interest in fizzlers waned in the 1980s when it was showed that, although fizzlers could exist, they only occupied a small part of the precollapse core parameter space for cold equations-of-state (EOS). Interest in fizzlers was revived in the late 1990s when it was found that *fizzlers* could form under a wider range of conditions than had been suggested if hot dense EOSs were considered. Observationally, interest in fizzlers was also driven by the recognition that *fizzlers* could lead to the generation of gravitational wave emission in Type II Supernovae, emission potentially observable by LIGO, the Laser Interferometer Gravitational Wave Observatory), and other gravitational wave observatories, and that fizzlers could perhaps play roles in the γ-ray burster phenomenon and the formation of *strange* stars. We review the properties of *fizzlers* and consider their applications to LIGO, strange stars, and *Magnetars.*