An Intermediate-Mass Binary Star Origin of Long Gamma-ray Bursts

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The stellar origin of gamma-ray bursts can be explained by the rapid release of energy in a highly collimated, extremely relativistic jet. This in turn appears to require a rapidly spinning highly magnetised stellar core that collapses into a magnetic neutron star or a black hole within a relatively massive envelope. They appear to be associated with type Ib/c supernovae but, with a birthrate of around $10^{-6} - 10^{-5}$ per year per galaxy, they are considerably rarer than such supernovae in general. To satisfy all these requirements we hypothesize a binary star model that ends with the merging of an oxygen neon white dwarf with the carbon-oxygen core of a naked helium star at the end of a common envelope phase of evolution. The rapid spin and high magnetic field are natural consequences of such a merging.