The white dwarf cooling age of NGC 6791

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NGC 6791 is a metal-rich ([Fe/H]=+0.4), well populated (∼3,000 stars) and nearby ($m - M = 13.44^{\rm mag}$) open cluster that has been imaged down to luminosities below those of the faintest white dwarfs, allowing us to obtain a reliable white dwarf luminosity function. The main-sequence turn-off age (∼8 Gyr) and the age derived from the termination of the white dwarf cooling sequence (∼6 Gyr) are very different. One possible explanation is that as white dwarfs cool, one of the ashes of helium burning, ^{22}Ne, sinks in the deep interior of these stars. At lower temperatures, white dwarfs are expected to crystallize and phase separation of ^{12}C and ^{16}O is expected to occur. This sequence of events is expected to introduce significant delays in the cooling times, but has not hitherto been proven. Here we present conclusive evidence that this indeed the case. We also assess the fraction of non-DA white dwarfs in the cluster, and we outline possible future applications of this cluster.