Ultra-massive white dwarf models

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Ultra-massive white dwarfs ($1.05M_{\odot} > M_{WD}$) are particularly interesting objects that allow us to study extreme astrophysical phenomena such as type Ia supernovae and micronovae explosions and merger events. Despite the large interest in ultra-massive white dwarfs, there is not a clear consensus in the literature whether these stars harbour oxygen-neon (ONe) or carbon-oxygen (CO) cores. In addition, the new observations provided by the ESA *Gaia* space mission indicate that a fraction of the ultra-massive white dwarfs experience a strong delay in their cooling, which cannot be attributed only to the occurrence of crystallization, thus requiring an unknown energy source able to prolong their life for long periods of time. This phenomenon, reflected both in their kinematic and photometric properties, is known as "the cooling anomaly of ultra-massive white dwarfs". In this talk I present detailed ultra-massive white dwarf models both for CO and ONe core-chemical composition, that consider realistic chemical profiles and all the relevant energy sources that control their evolution, such as latent heat and phase separation due to crystallization and ^{22}Ne sedimentation. We show that the energy released by ^{22}Ne sedimentation in the deep interior of ultra-massive white dwarfs with CO cores is in line with the long cooling delay of these stellar remnants. I will also briefly describe other possible solutions to the "cooling anomaly of ultra-massive white dwarfs".