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White dwarf crystallization

The evolution of white dwarfs is a gravothermal process of cooling that allows them to be used for reconstructing or at least for constraining the evolution of several Galactic populations of stars. . One of the sources of energy is crystallization via latent heat release and sedimentation of the heavier chemical species induced by a change of solubility during the transition liquid-solid and the subsequent release of gravitational energy.

Thanks to the Gaia mission and the spectroscopic information obtained by different surveys it has been possible to find structures in the HR-domain of white dwarfs and in their luminosity function that provide support to the importance played by crystallization and the associated sedimentation.

Crystallization not only modifies the distribution of the main chemical components like C/O or O/Ne, it can also modify the distribution of minor components like ^{22}Ne or ^{56}Fe which, despite their low abundance, can play a very important role thanks to their excess of neutrons: they can release important amounts of gravitational energy, modify the yields of critical isotopes during SNIa or, perhaps, excite a dynamo mechanism in cold white dwarfs.