Asteroseismology of helium core white dwarf stars

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Helium core white dwarf stars populate the low mass domain of the white dwarf distribution. In the Galactic field, helium core white dwarfs are commonly found in binary systems, typically in ultra-compact X-ray binaries. Also, in the last few years, numerous helium core white dwarf candidates have been discovered in open and globular clusters, like, NGC 6793 and NGC 6791. The presence of these objects in clusters could be related to extreme mass loss episodes in early stages of the pre-white dwarf evolution or by evolution in compact binaries. Even though photometric variability has not been yet detected in this kind of stars, they are expected to show brightness variations due to pulsation instabilities. Motivated by the asteroseismological potential of helium core white dwarf stars, we present a full adiabatic and nonadiabatic pulsational study applied to these objects. This survey is aimed to provide a theoretical basis from which to interpret future observations. The model sequences were derived by taking full account of the evolutionary history of the progenitor star, with special emphasis on the diffusion processes acting during the white dwarf cooling sequence. We analyse the expected properties of the nonradial pulsation period spectrum, in particular for gravity and acoustic dipole modes. In addition, we present an extensive stability analysis of our helium core white dwarf models by studying the properties of the theoretical instability strip, its dependence with the stellar mass and the range of period expected to be excited.