A detailed modeling of the DO-to-DA spectral evolution

Antoine Bédard, Pierre Bergeron, Pierre Brassard

Département de Physique, Université de Montréal, Montréal, QC H3C 3J7, Canada

The variation of the fraction of helium-atmosphere white dwarfs along the cooling sequence conclusively reveals that spectral evolution takes place among white dwarfs. In particular, at high temperature ($T_{\rm eff} > 30,000$ K), it is empirically well established that $\sim$2/3 of all helium-rich DO stars eventually turn into hydrogen-rich DA stars. This transformation is usually interpreted as the result of the upward diffusion of residual hydrogen, although this process remains poorly studied from a theoretical perspective. In this talk, I will present state-of-the-art evolutionary calculations that follow the diffusion and mixing of residual hydrogen in hot helium-rich white dwarfs. I will then discuss a few interesting implications of these models for our understanding of spectral evolution. More precisely, I will show that our calculations (1) allow us to constrain the total hydrogen content of hot DO white dwarfs; (2) indicate that the so-called convective dilution mechanism, which is generally believed to turn DA stars into DB stars at low temperature ($T_{\rm eff} < 30,000$ K), is actually unlikely to occur in nature; (3) provide new insights into the long-standing problem of the origin of hydrogen in cool DBA white dwarfs.