The atmospheric structure and fundamental parameters of the late-type supergiants V766 Cen (=HR5171A), σ Oph, BM Sco, and HD 206859

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Spectro-interferometry of red giants and supergiants

- Established project:
  - Wittkowski et al. 2012: VY CMa (M3-4)
  - Arroyo Torres et al. 2013: AH Sco (M5), UY Sct (M3-4), KW Sgr (M4)
  - Arroyo Torres et al. 2015: V602 Car (M3) , HD 95687 (M2) , HD 183589 (K5)
  - Main conclusions:
    - Red supergiants exhibit extended molecular layers that cannot be explained by 1D and 3D pulsation and convection models, indicating a missing physical process in the models
    - Red supergiants are confirmed to lie in the HR diagram at the red edge of current evolutionary models
- Addition:
  - Wittkowski et al. (in prep): Warmer supergiants of spectral types G5 to K3: V766 Cen (=HR 5171 A, G8), σ Oph (K2), BM Sco (K2), HD 206859 (G5)

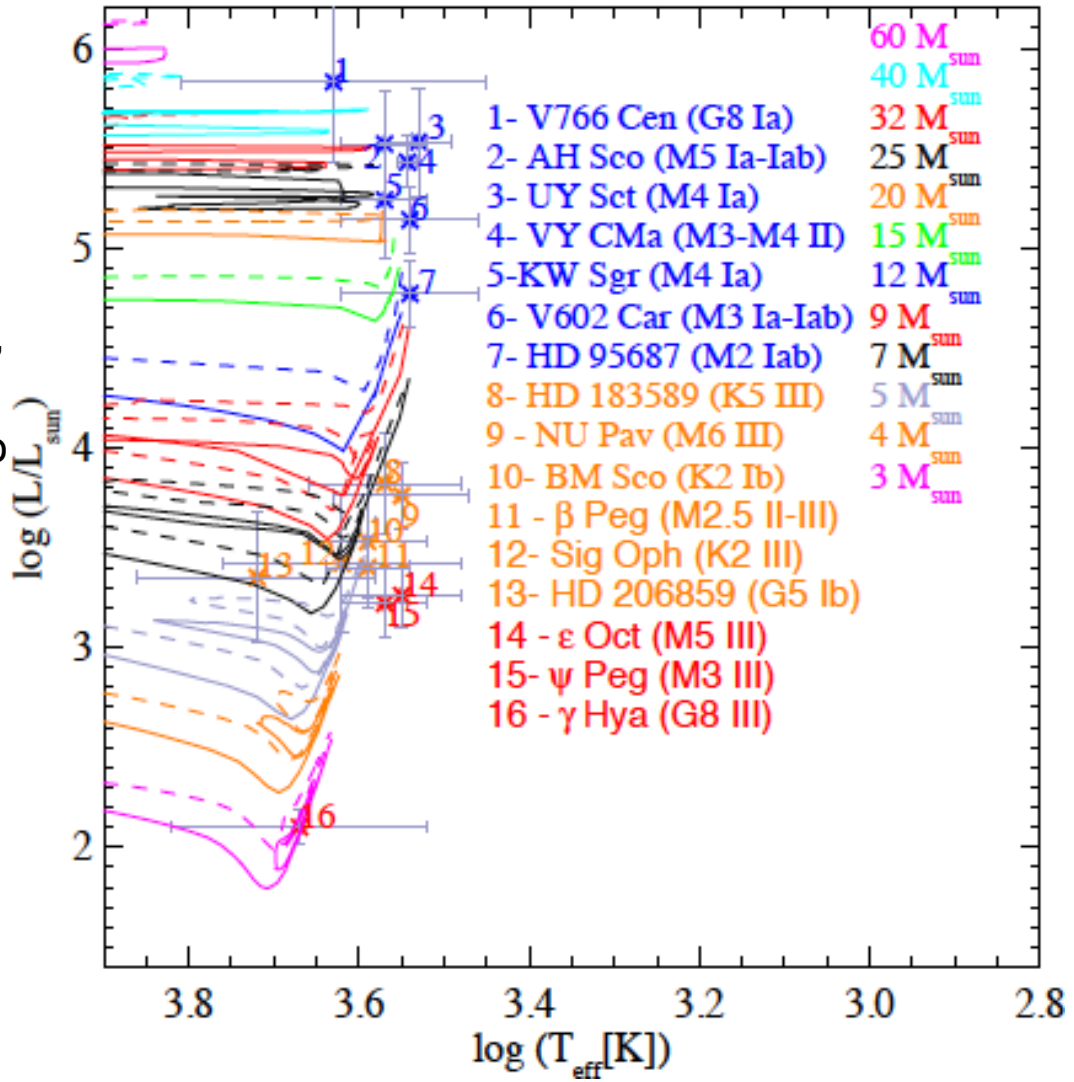
Updated positions in the HR diagram

V766 Cen:

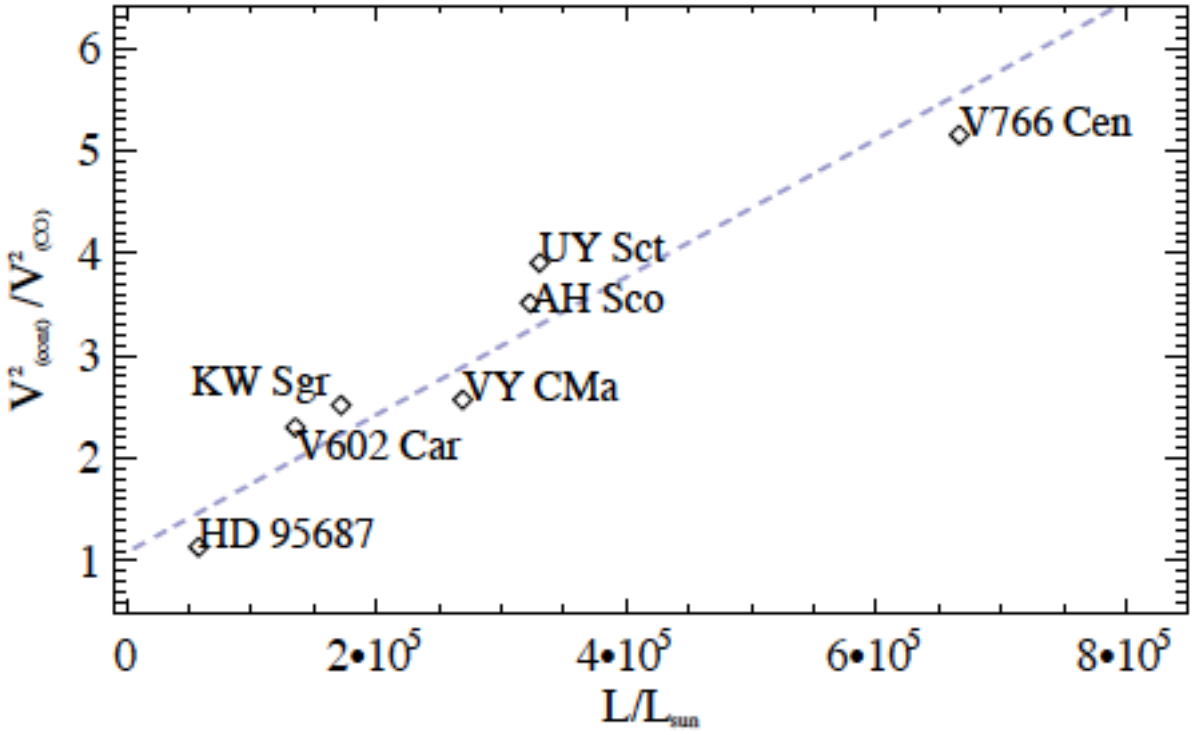
- Discussed as YHG; Chesneau et al. (2014) suggested a close companion
- We find it to be a high-luminosity, high-mass (40 M_{sun} track) red supergiant close to the Hayashi limit and to the Eddington luminosity.
- Relatively faint CO features in the spectra (G8), but spatially strongly extended
- NaI doublet spatially resolved, corresponding to a shell of 1.5 R_{phot}

BM Sco, σ Oph, HD 206859:

- Lower luminosities, lower masses (5-9 M_{sun} tracks), relatively small radii, no indication of extended molecular layers: higher mass red giants instead of supergiants
- Gap at log L/L_{sun}~3.8-4.8, masses 10-13 M_{sun}, corresponding to mass range of red supergiant progenitors of type II-P SNe?
- BM Sco: Indication of circumstellar material, which is unusal at this position in the HR diagram



Updated relation of increasing atmospheric extension with increasing luminosity



- Confirmed to reach up to V766 Cen
- Close to the Eddington luminosity
- Further evidence for increasing radiative winds (on molecular lines) with increasing luminosity?