Massive stars in the Galactic center

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Outline

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  $> 60M_\odot$:
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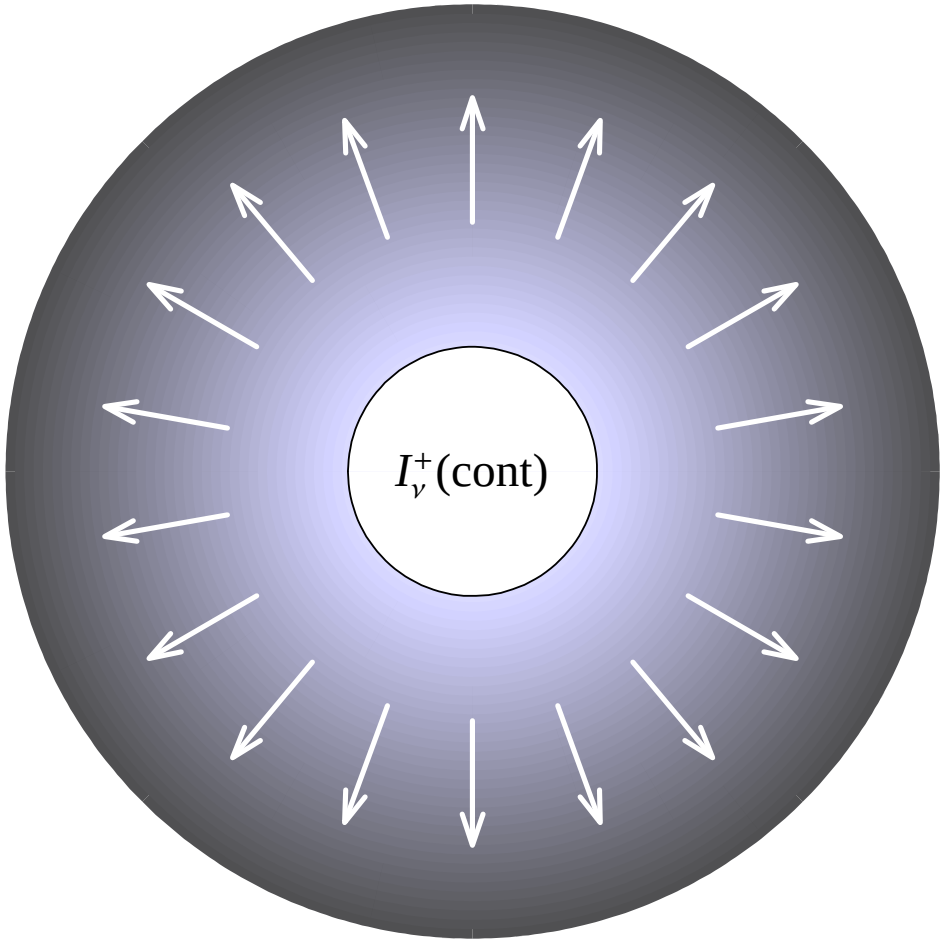
KEY PLAYERS in COSMIC RECYCLING!

Stellar winds

- Castor, Abbott and Klein - CAK theory 1975 radiative pressure on spectral lines in the atmosphere



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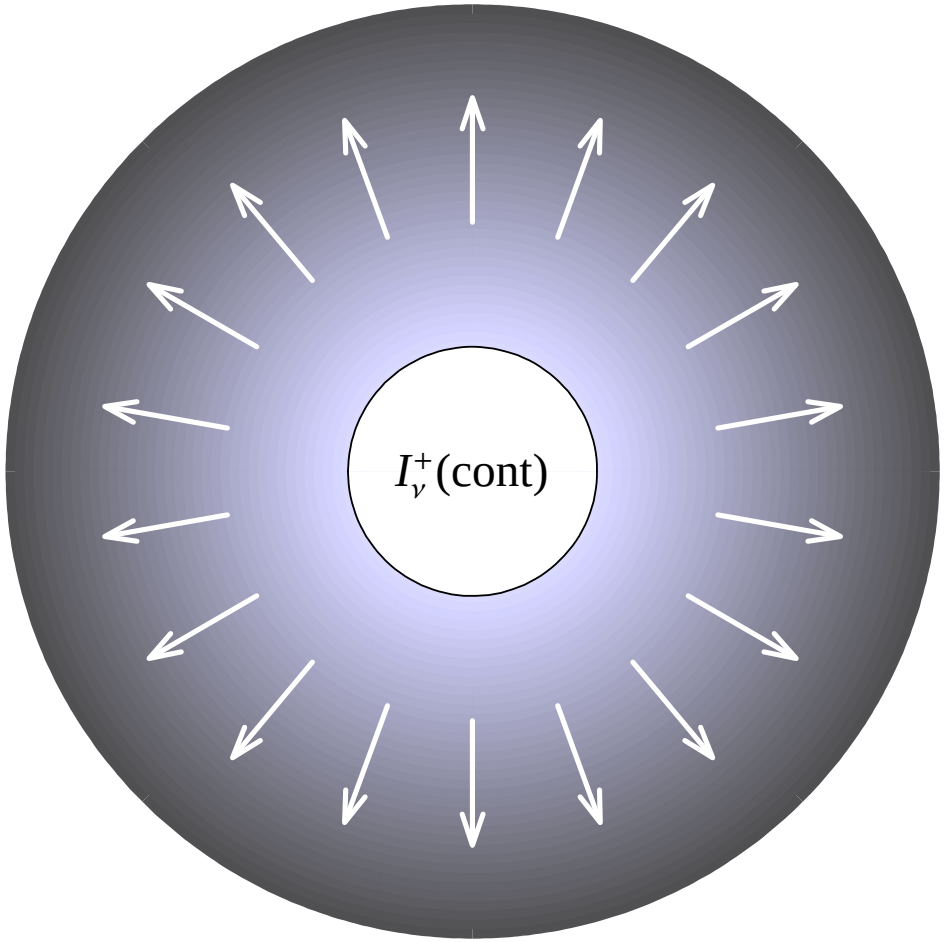

Stellar winds

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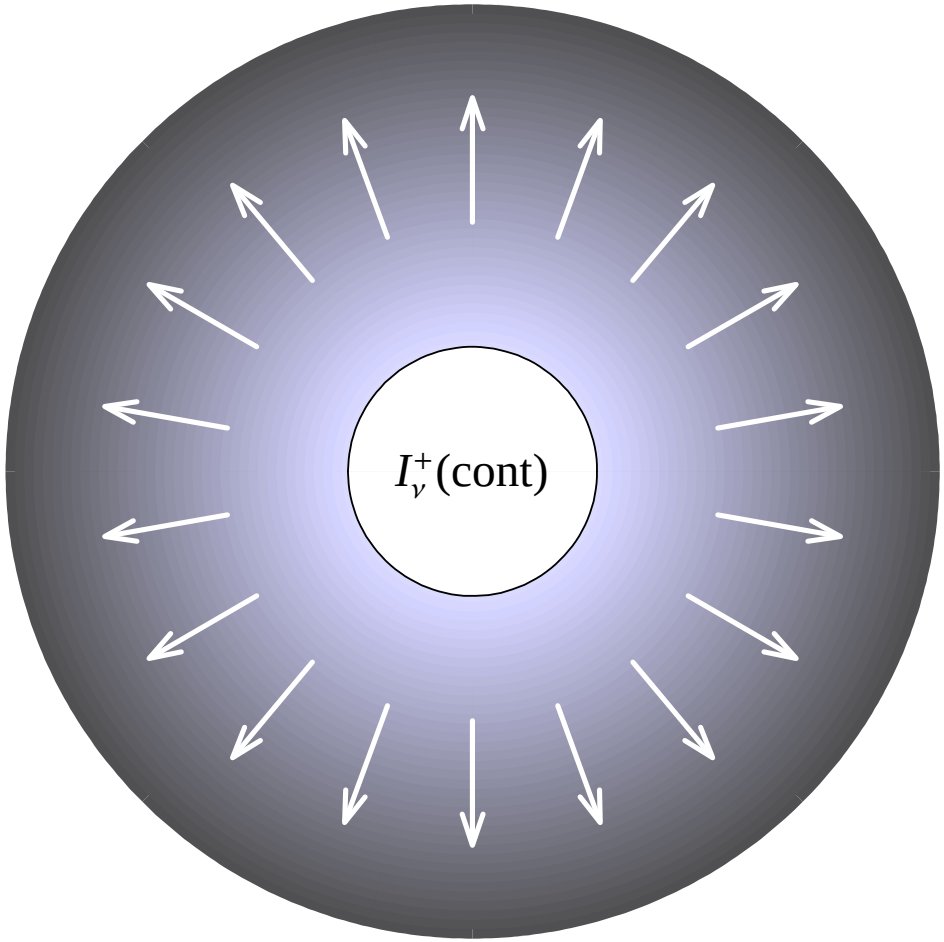
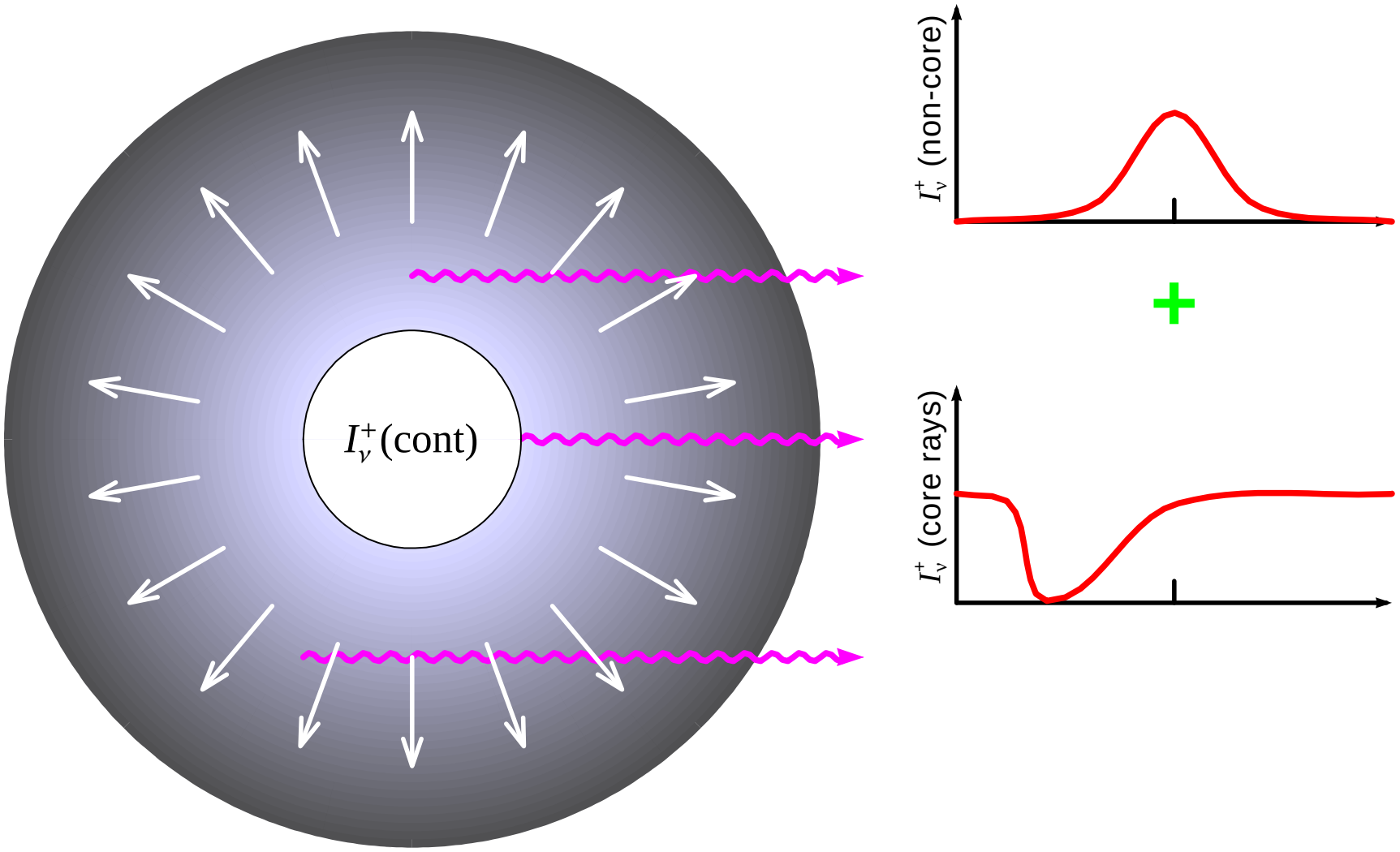
- photon momentum transfer
- Nugis & Lamers 2000: WN stars $\dot{M} \sim L^{1.7}$



Observation - P Cygni line profiles



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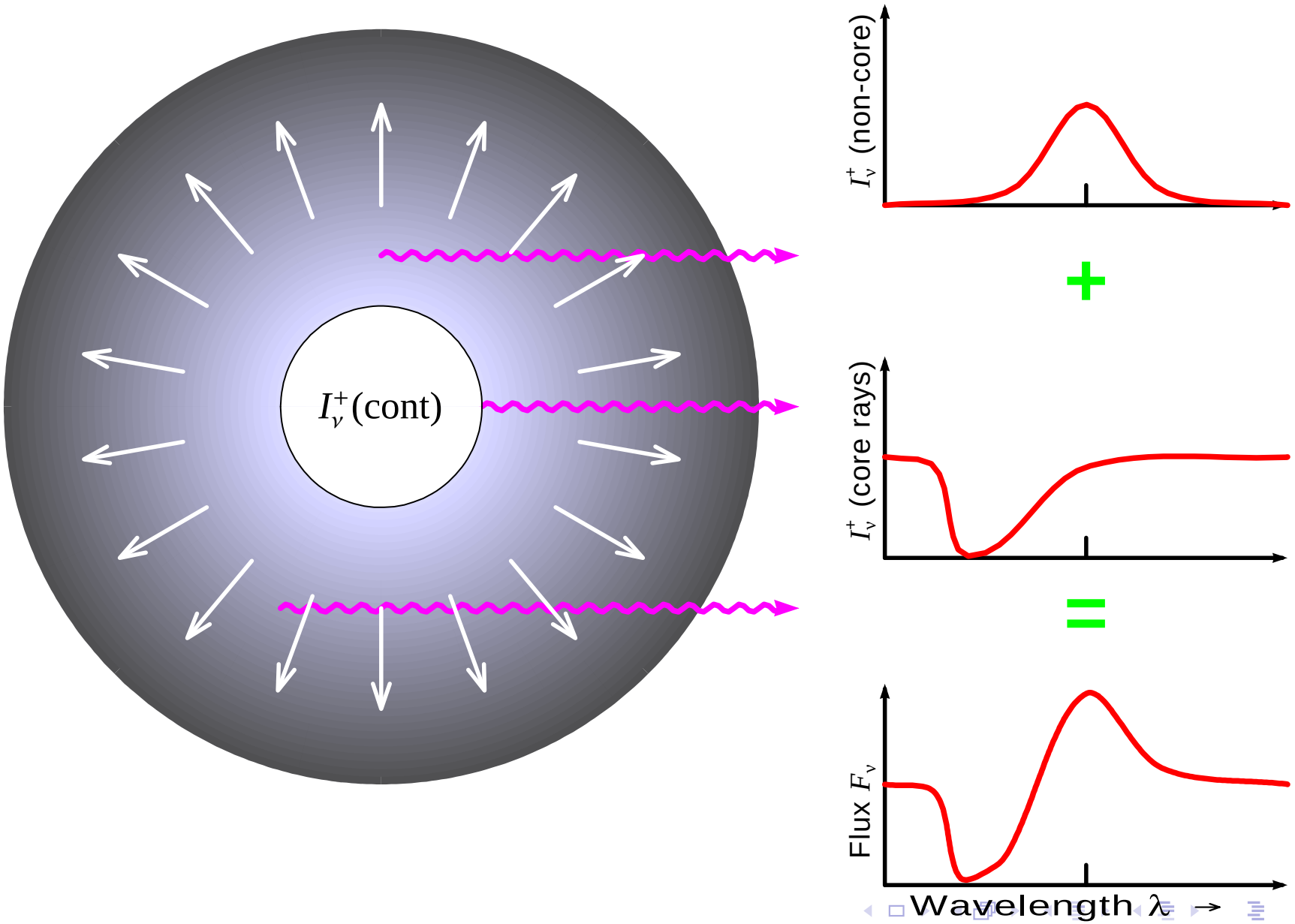
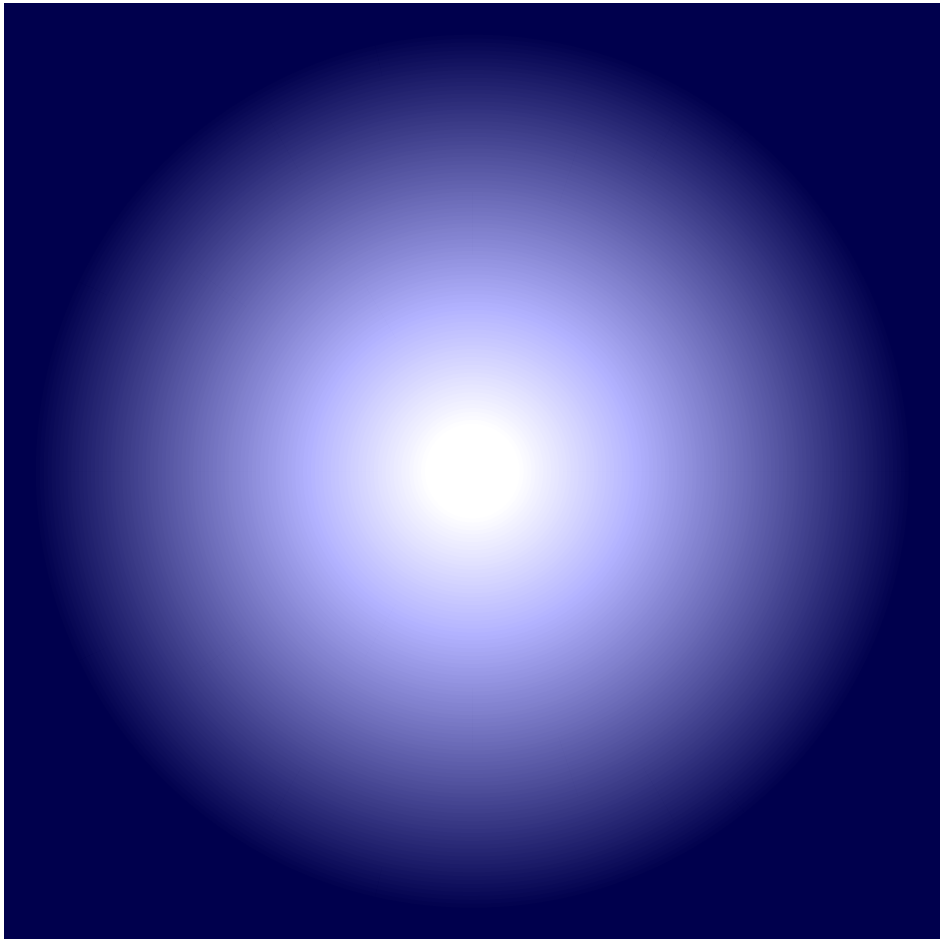


PoWR - Potsdam Wolf-Rayet code for expanding atmospheres (Hamann et al.)

- spherical symmetric stationary atmosphere



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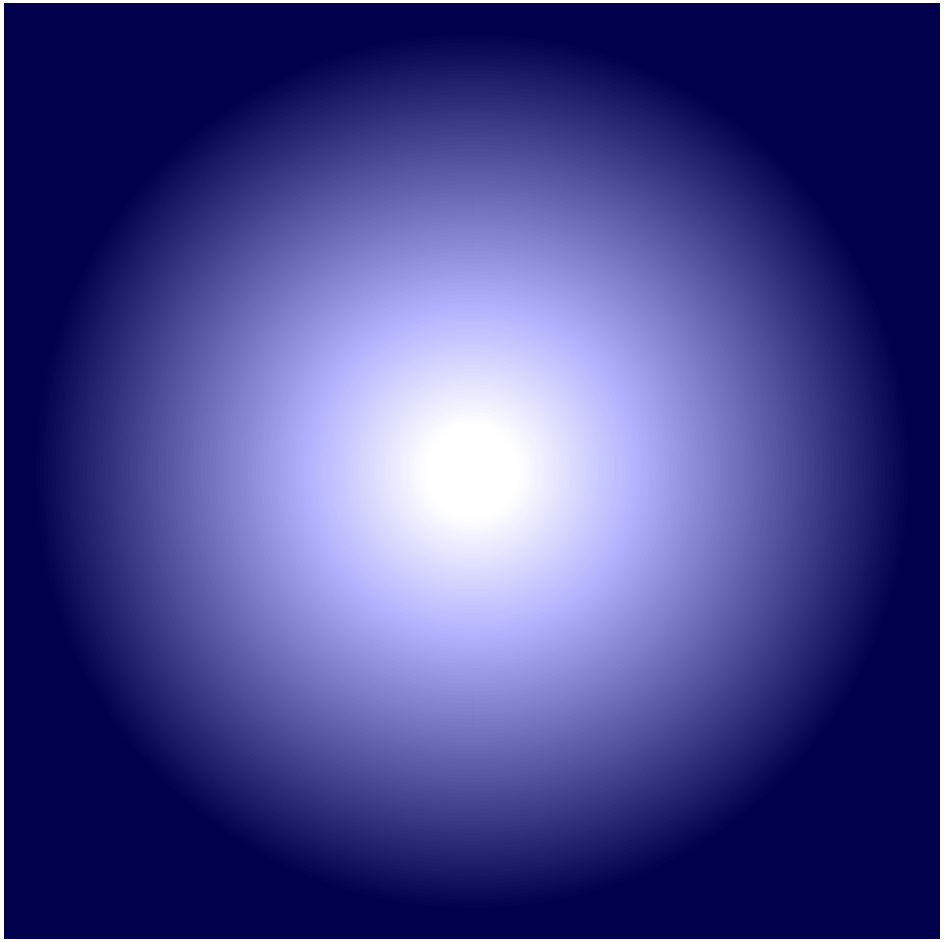
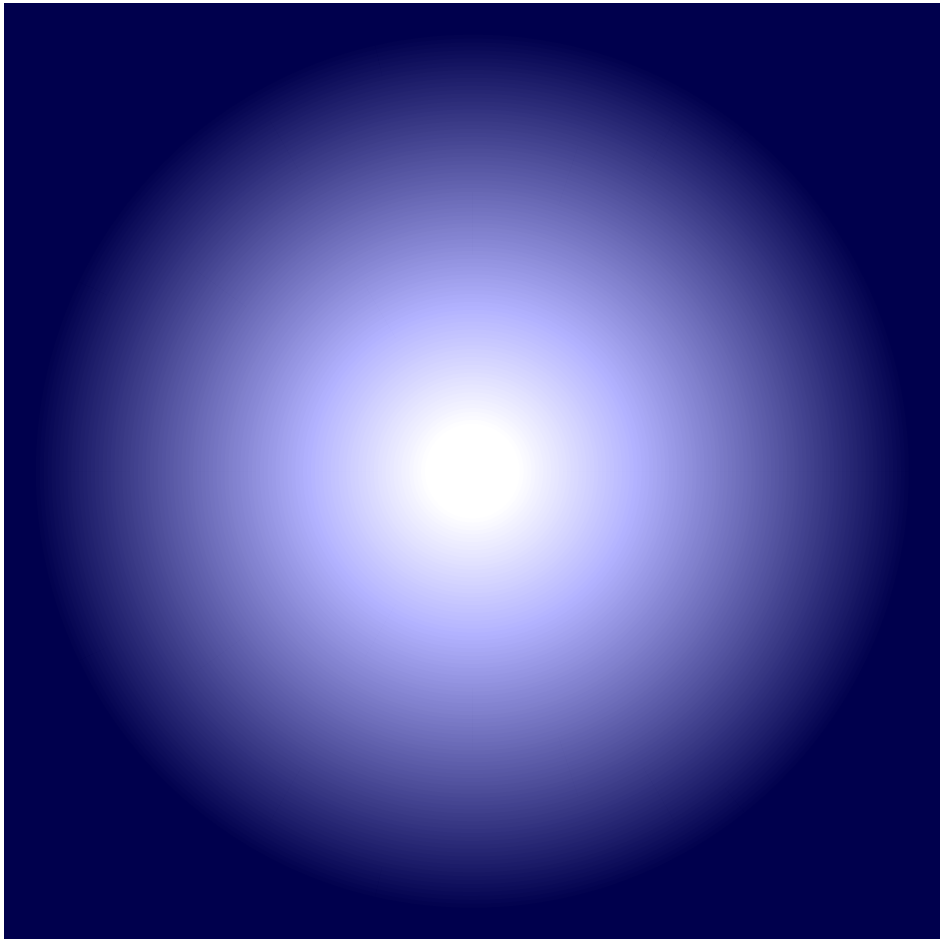


PoWR - Potsdam Wolf-Rayet code for expanding atmospheres (Hamann et al.)

- spherical symmetric stationary atmosphere
- full non-LTE: populations numbers with rate equations radiate transfer in co-moving frame
- ensure statistical equilibrium & energy conservation



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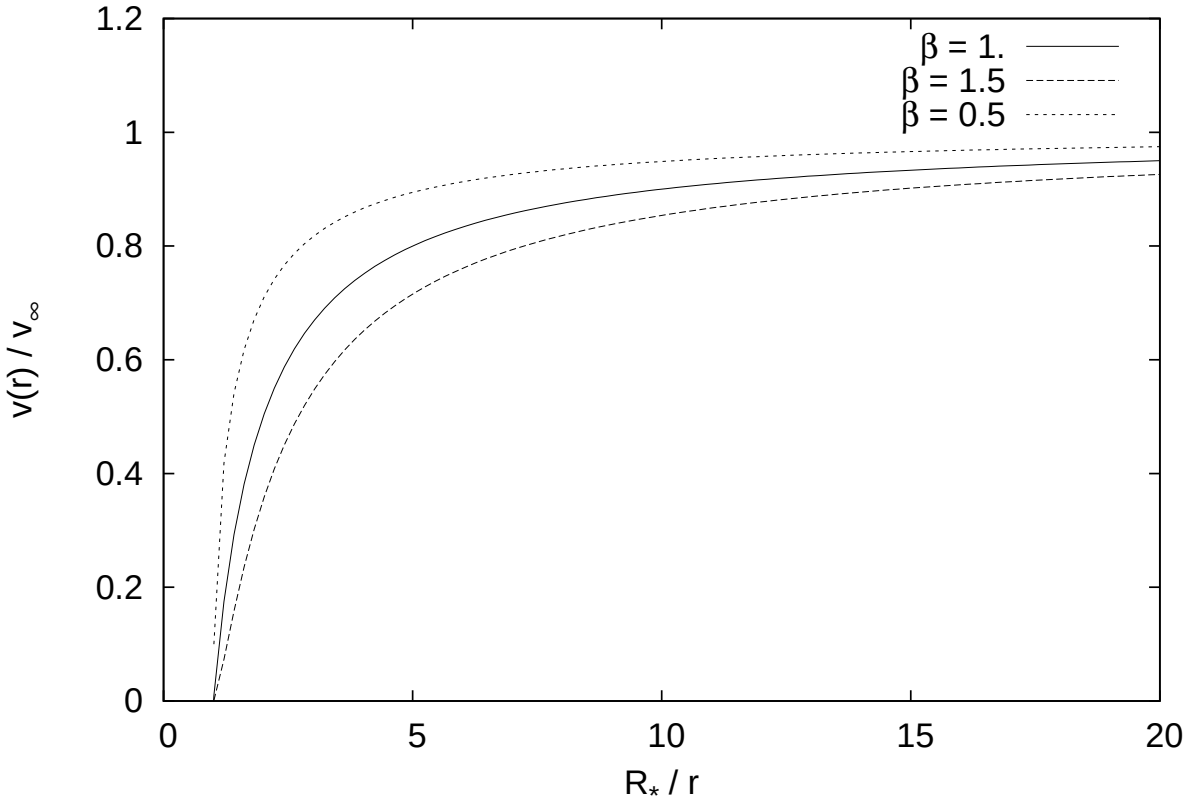

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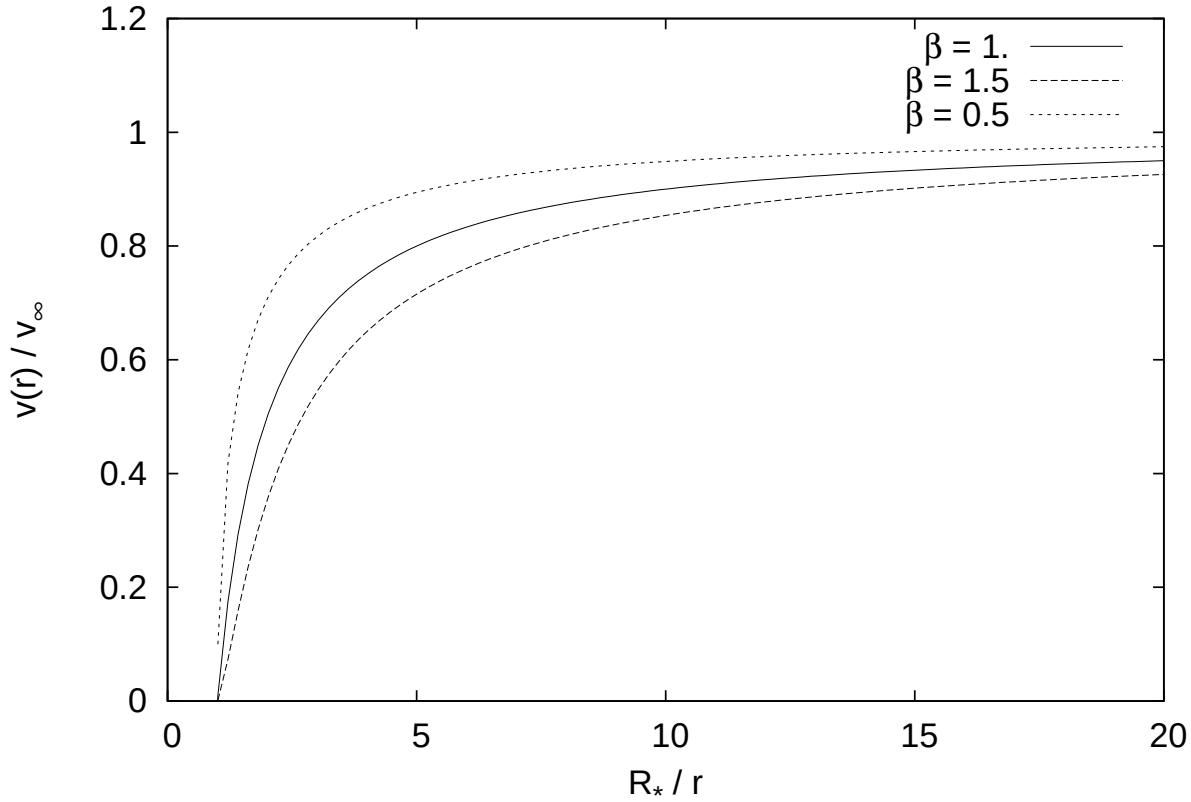

scale invariance: $R_\mathrm{t} = R_* \left[\frac{v_\infty}{2500\,\mathrm{km/s}} \Big/ \frac{\dot{M}\sqrt{D}}{10^{-4} M_\odot \mathrm{a}^{-1}} \right]^{2/3}$

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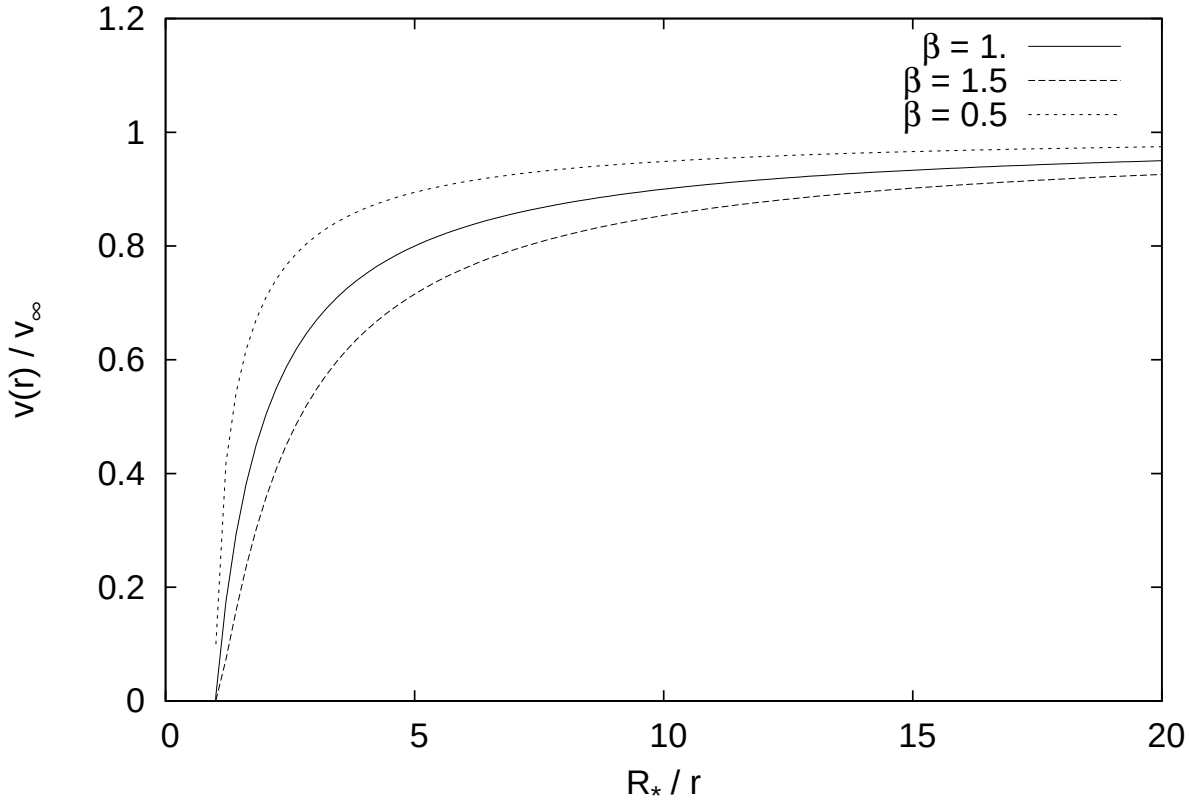

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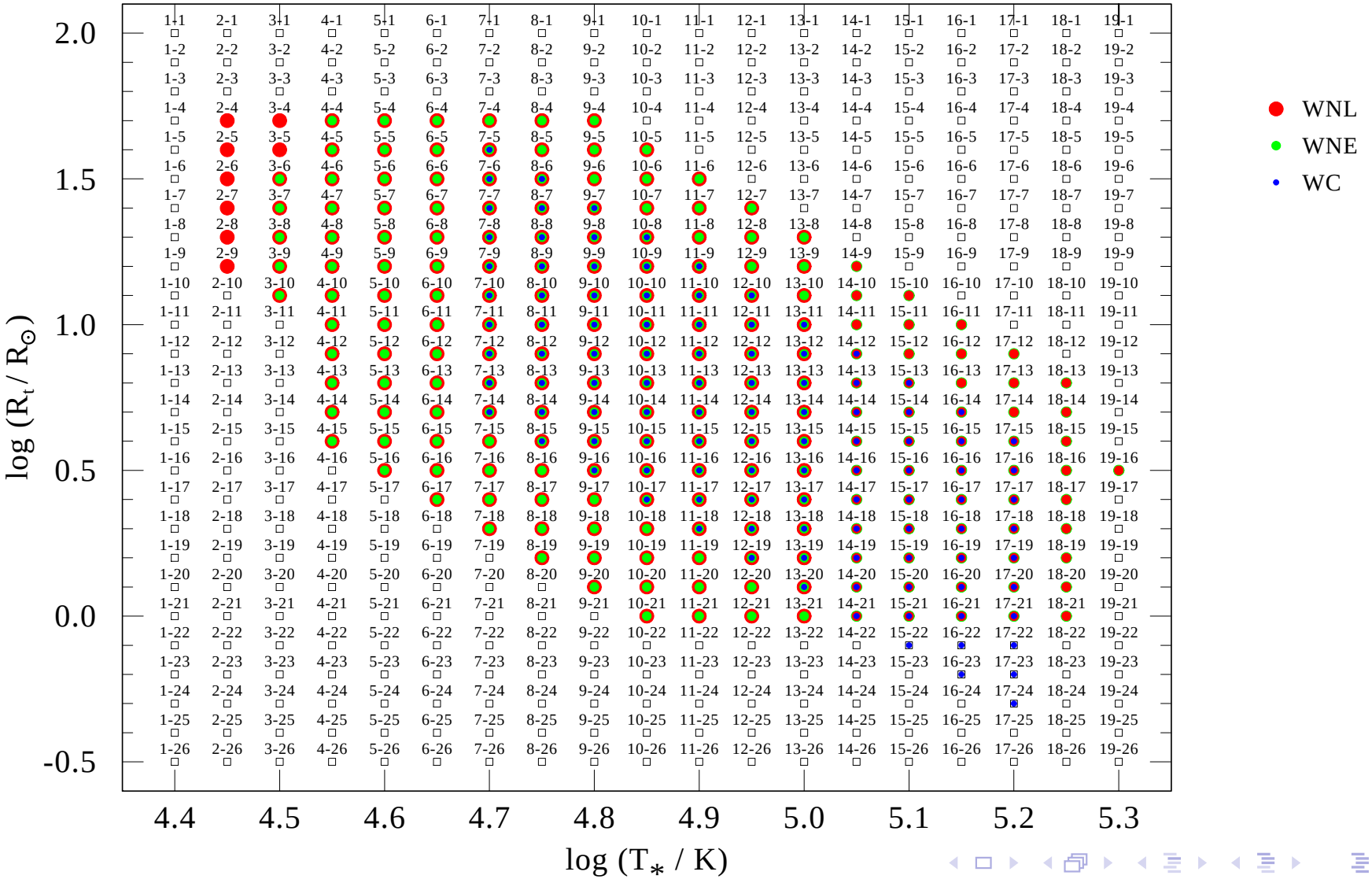
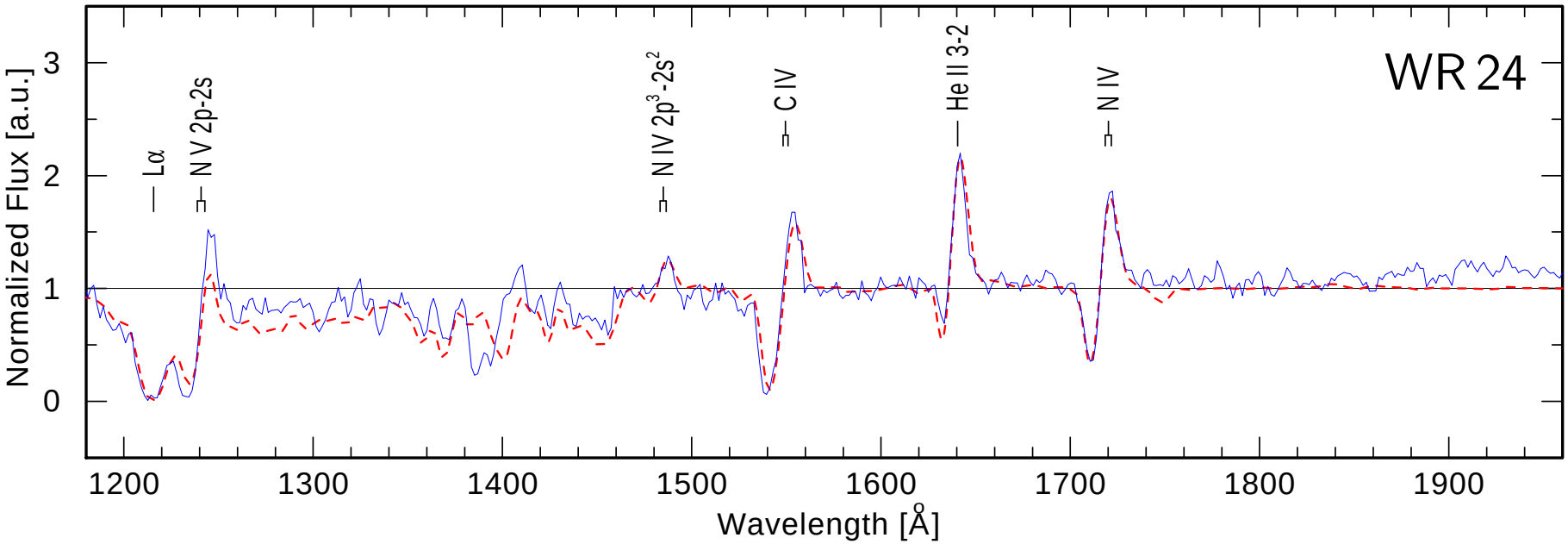
PoWR - model grids

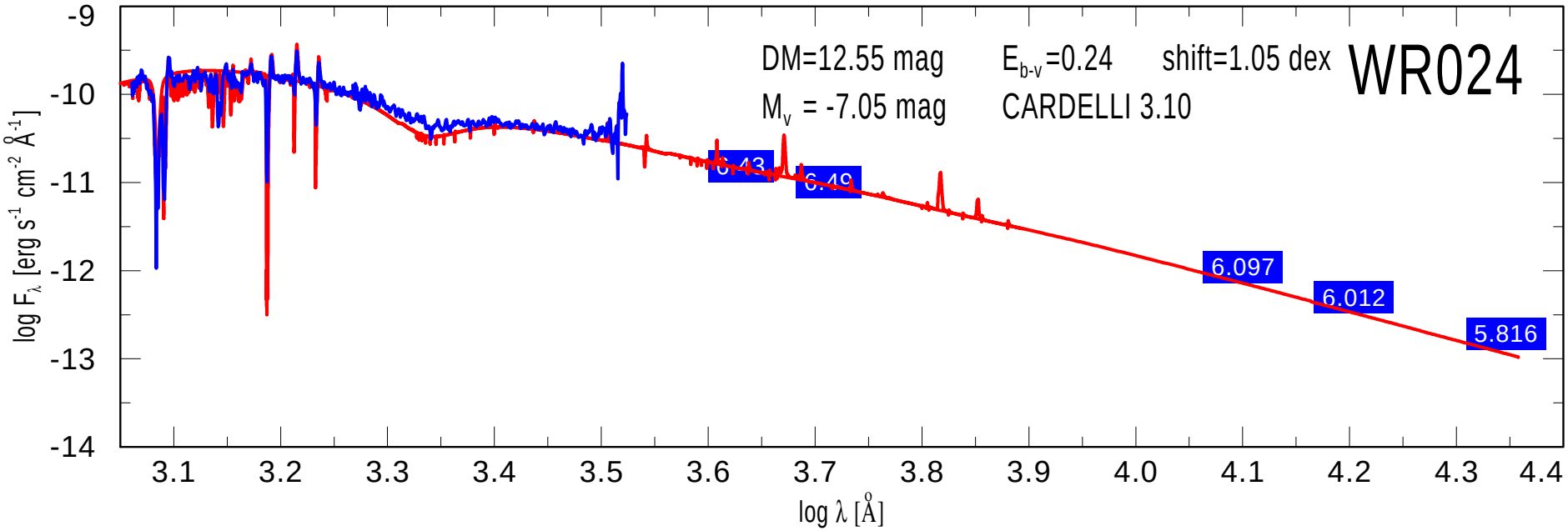


Fitting an emission line spectrum



synthetic spectrum: simultaneous fit from UV to IR

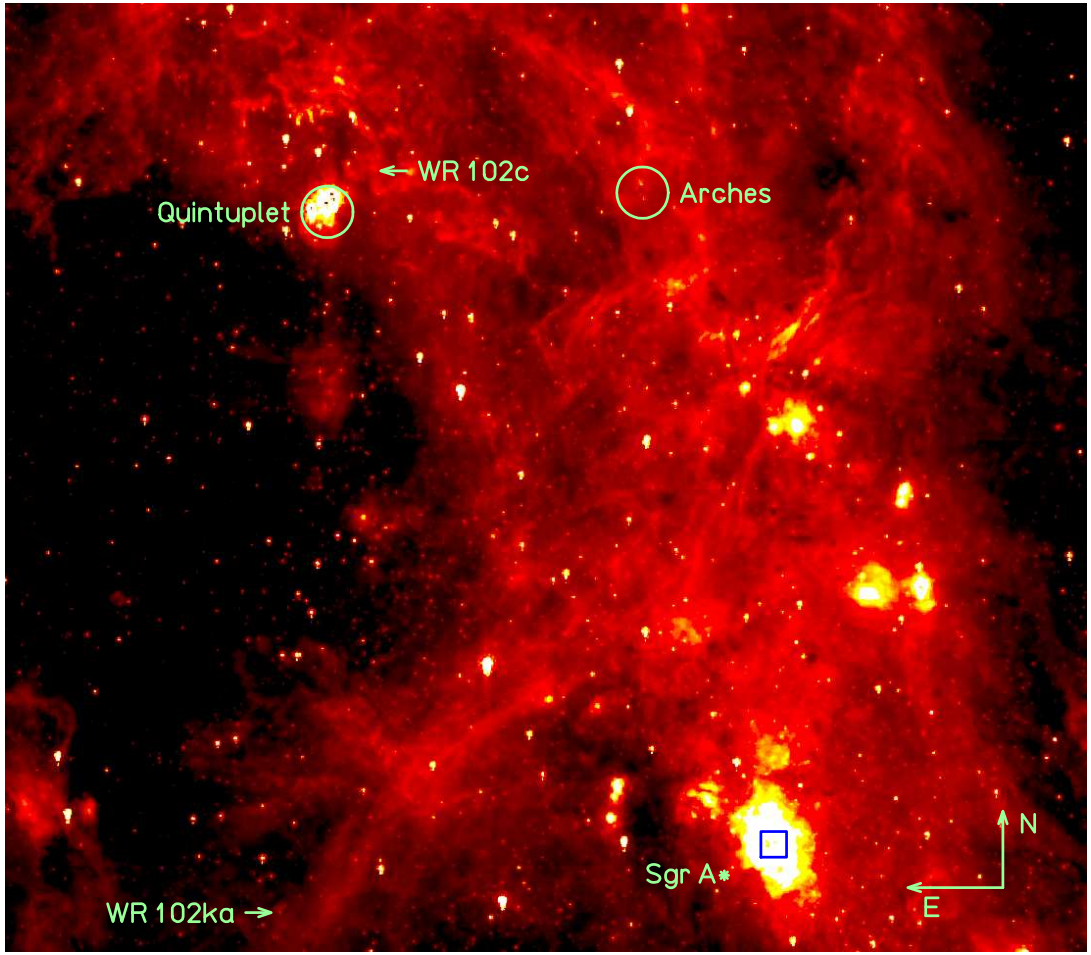
Fitting a spectral energy distribution



include interstellar reddening

The Galactic Center

- accessible by IR and radio observations
- 3 young massive stellar clusters: Arches, Quintuplet, Central cluster
- stellar population: massive stars!

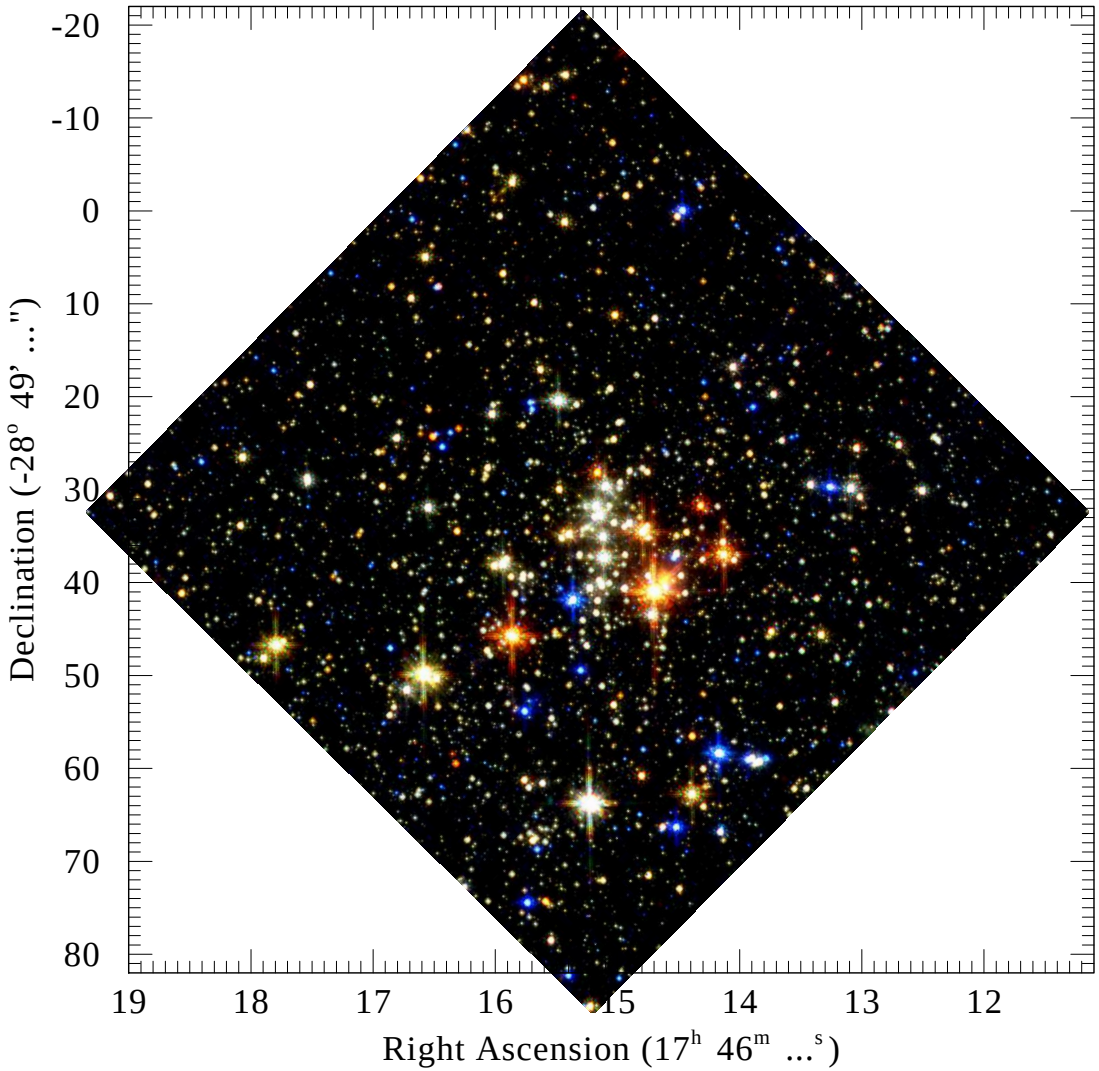


Spitzer (NASA)

The Quintuplet Cluster

- massive cluster $\sim 10^4 M_\odot$
- 30 pc proj. distance from GC
  (Okuda et al 1989, 1990)
- 4 Mio. years old
  (Figer et al. 1999)
- cluster radius ca. 1 pc

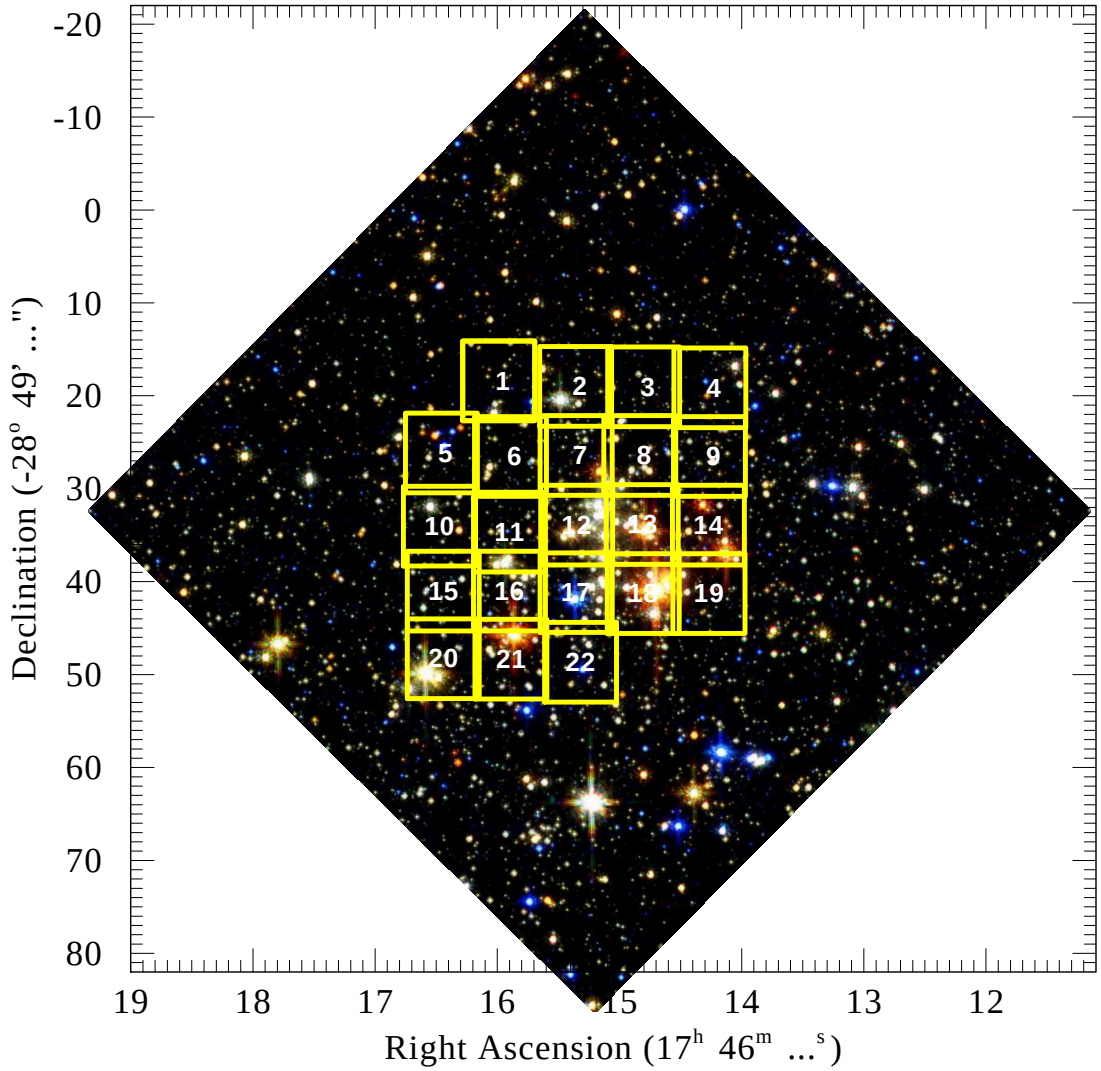
- named after 5 prominent (back then featureless) stars



(HST image, PI D. Figer, STScI)

The Observations

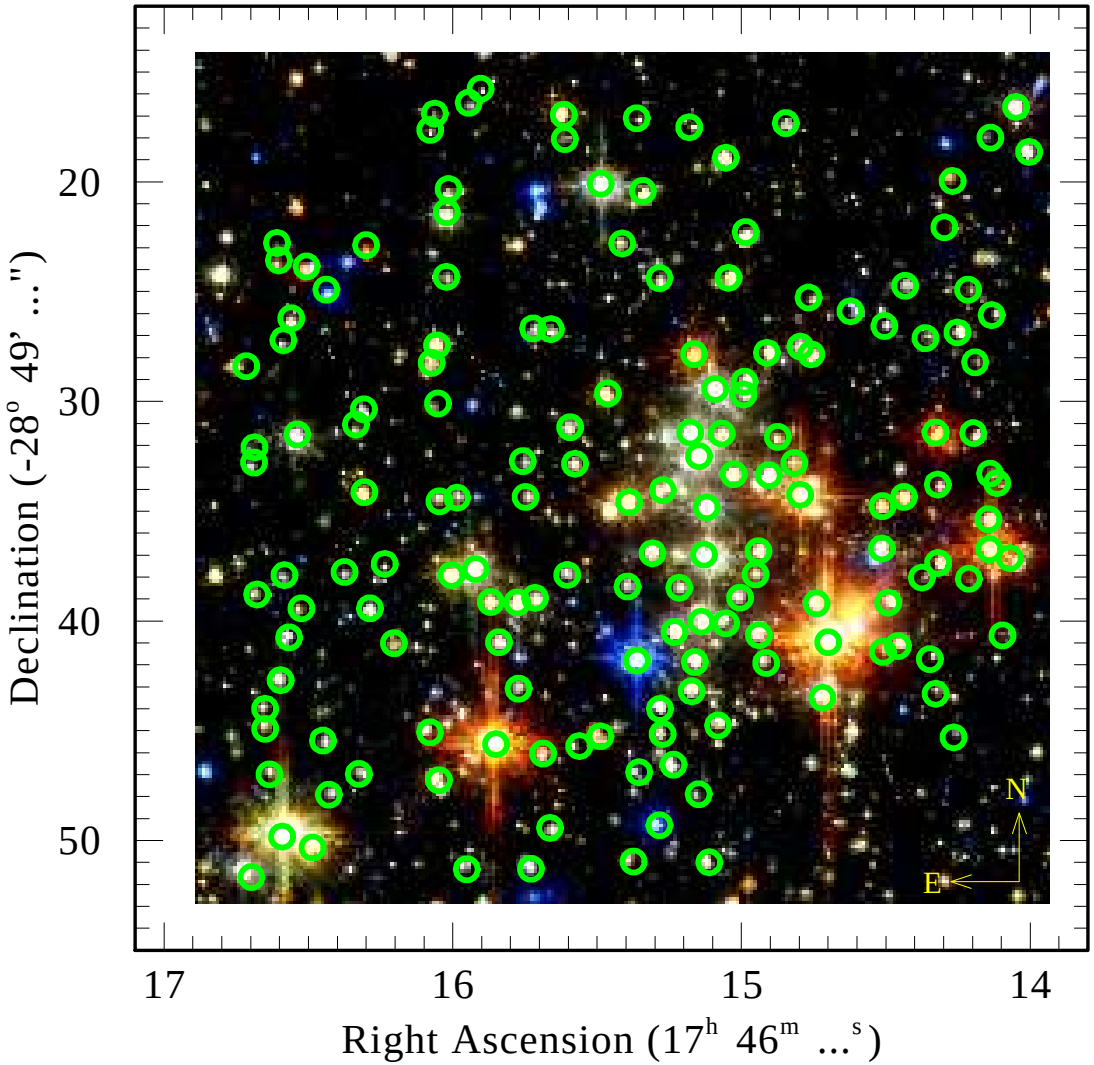
- ESO SINFONI-SPIFFI
- 22 target fields of 8×8 arcsec FOV
- near IR K-band (1.95 - 2.45 μm)



The Catalog

Liermann et al. 2009

- 160 flux-calibrated K-band spectra
- 98 early-type stars
- 62 late-type stars



The Catalog

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- 160 flux-calibrated K-band spectra
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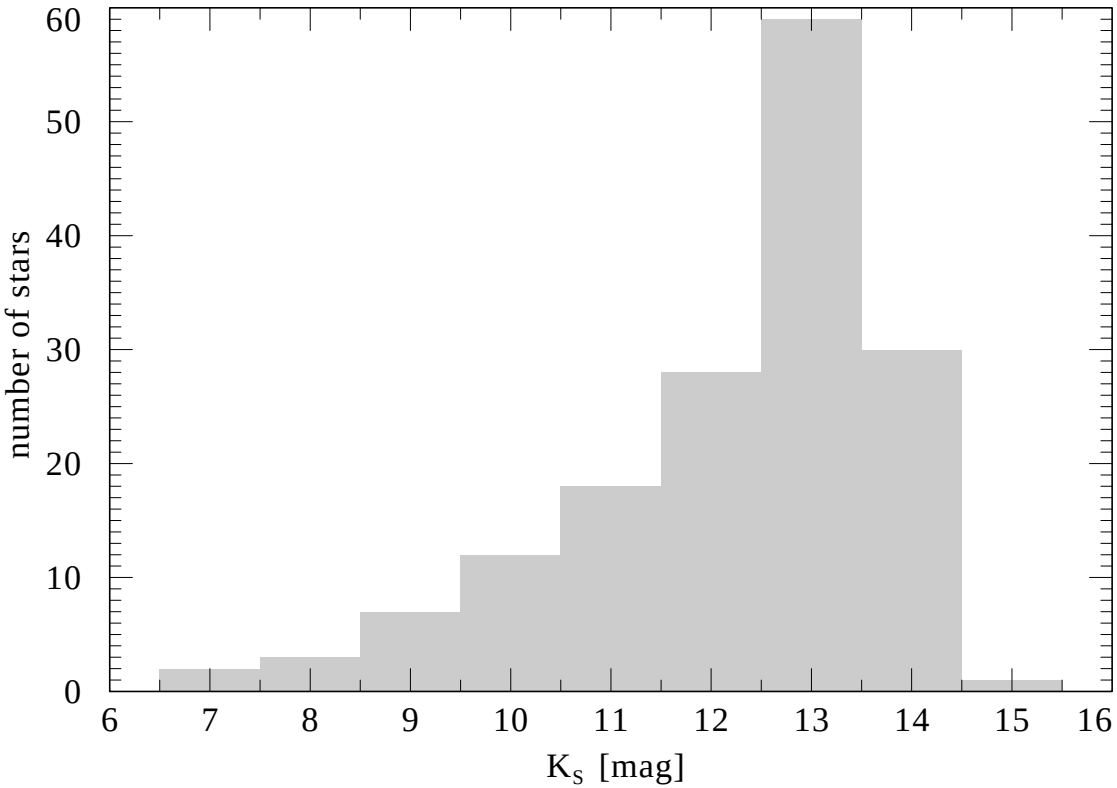
- synthetic K_S photometry



Massive evolved stars in the Quintuplet

- 4 WN stars & 9 WC stars (6 WN and 10 WC in total)

$\Rightarrow$ to be analyzed with PoWR code:
fit emission line spectra
fit spectral energy distribution
derive stellar parameters

Thanks for your attention