TWUIN Stars: Ionizing Sources in Low-Z Dwarf Galaxies

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Abstract

The evolution of massive stars is strongly influenced by their initial chemical composition. We have computed rapidly-rotating massive star models with low metallicity (~1/50 $Z_\odot$) that evolve chemically homogeneously and have optically-thin winds during the main sequence evolution. These luminous and hot stars are predicted to emit intense mid- and far-UV radiation, but without the broad emission lines that characterize WR stars with optically-thick winds. We show that such **T**ransparent **W**ind **U**ltraviolet **IN**tense (**TWUIN**) stars may be responsible for the high number of He II ionizing photons observed in metal-poor dwarf galaxies, e.g. I Zw 18.

Our conclusion is that the high HeII flux observed in dwarf galaxies can be a signpost for upcoming lGRBs in these objects. Additionally, the observed high HeII flux may argue that chemically-homogeneous evolution, which leads to the TWUIN stars, is indeed happening in nature.

A&A: Szécsi et al. 2015 [arXiv:1506.09132]

Talk: 5th Wednesday at 3:15 PM at FM 16

Talk: 11th Tuesday at 4:36 PM at FM 10

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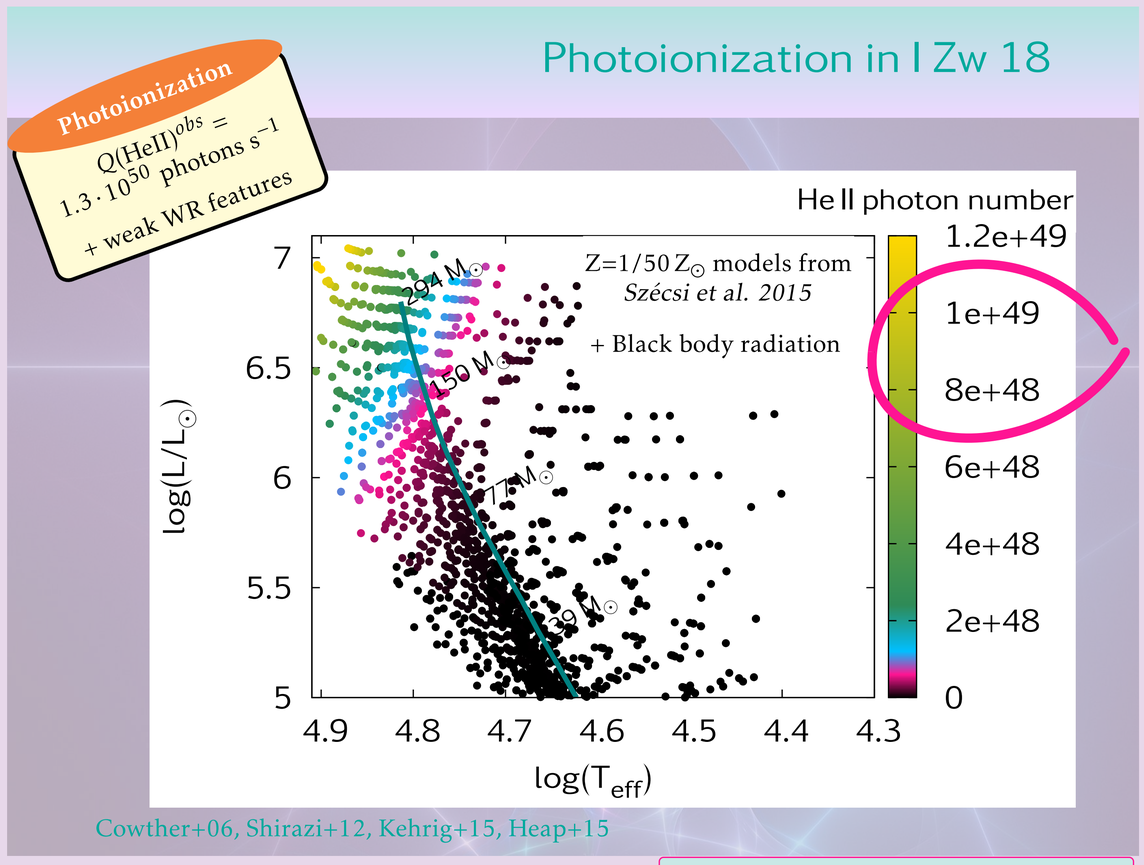
Are TWUIN stars real?

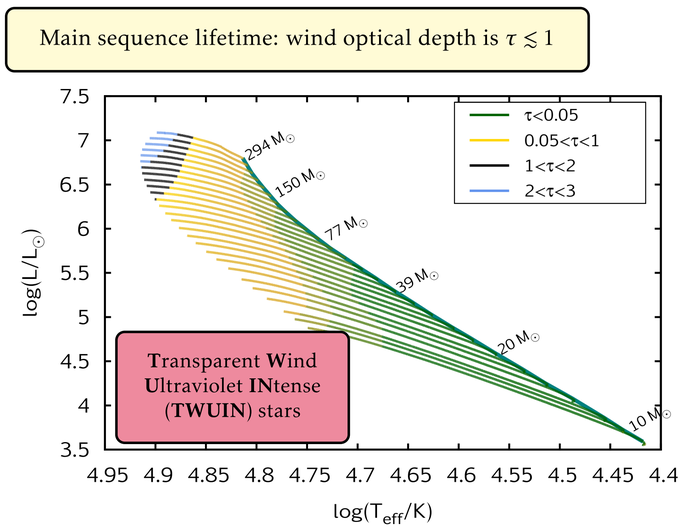


Cowther+06, Shirazi+12, Kehrig+15, Heap+15

TWUIN stars → HeII flux of I Zw 18 ✓
Transparent **W**ind **U**ltraviolet **IN**tense

simulated stellar population of I Zw 18:
$Q(He\,II)^{sim}=1.6 \cdot 10^{50}$ photons s^{-1}

TWUIN stars are *not* WR stars!

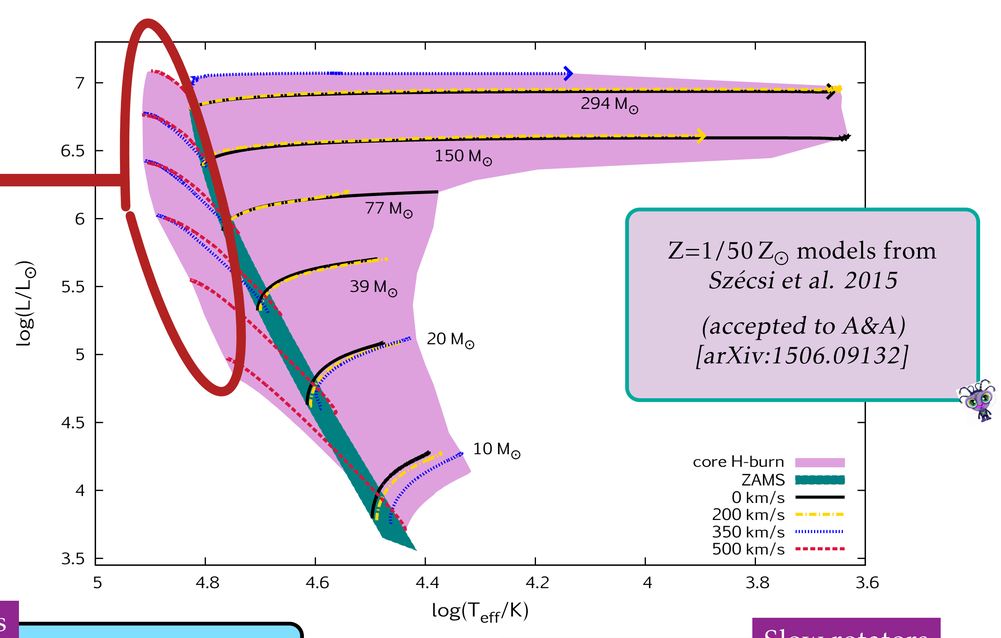


Stellar evolution at low-Z

Collapsar → lGRB

"angular momentum in the core is higher than the critical limit for the formation of an accretion disc around a rotating black hole"

(Yoon&Langer'05; Woosley&Heger'06; Yoon+06; Yoon+12)



Z=1/50 $Z_\odot$ models from *Szécsi et al. 2015*

(accepted to A&A) [arXiv:1506.09132]

Fast rotators

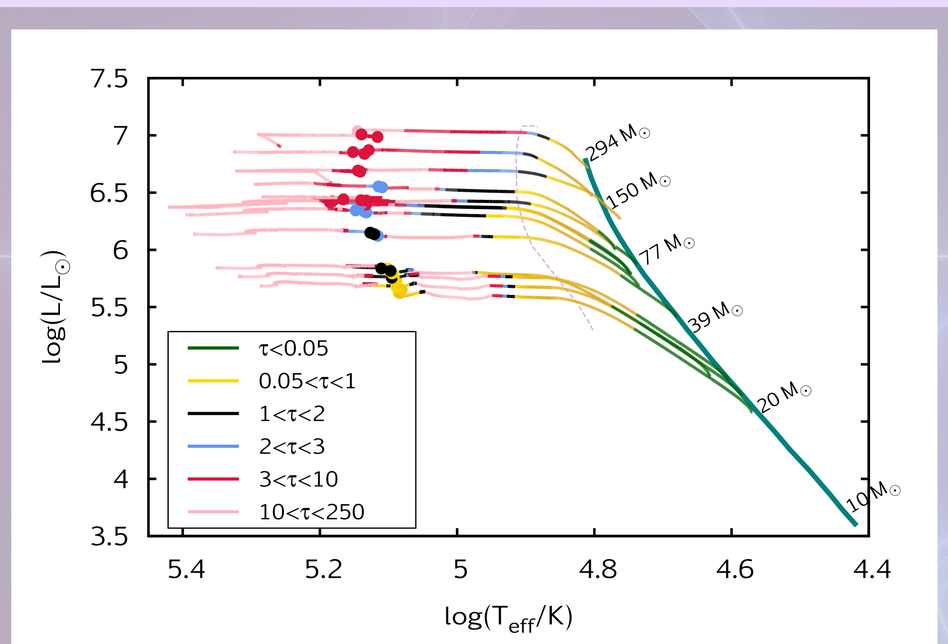
Rotational mixing → Chemically Homogeneous Evolution → TWUIN stars → WR stars → lGRB

Slow rotators

No enhanced mixing → Normal Evolution → RSGs → SN Type IIp

Post-MS phase of TWUINs

Post-MS phase of TWUIN stars



Takeaway message