

Common-envelope evolution and the fate of white dwarf binaries

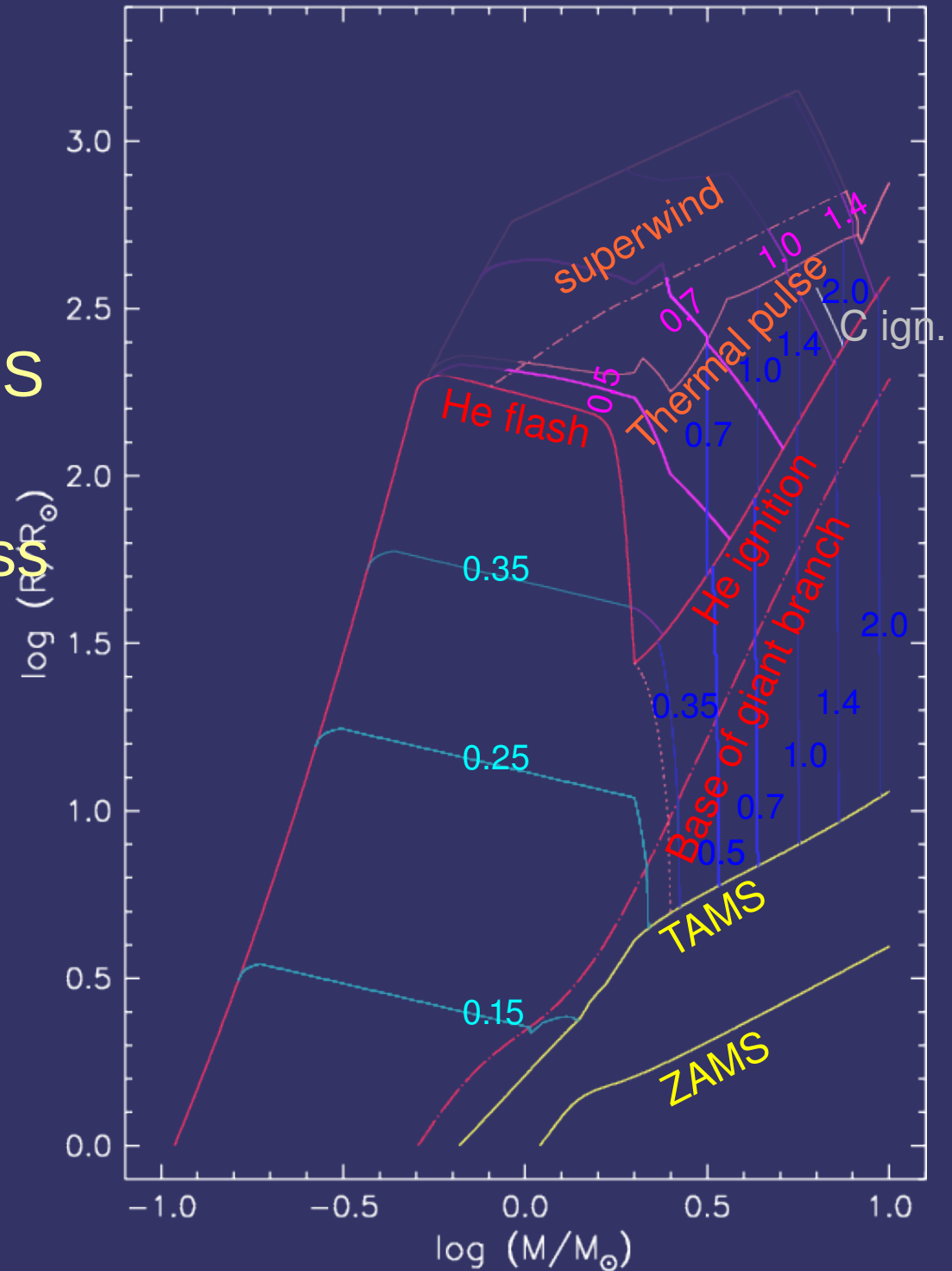
The background of the slide features a pair of white dwarf stars in a common envelope phase. The stars are depicted as bright, glowing spheres with a blue and purple color palette, surrounded by a diffuse, glowing blue and purple envelope. The stars are positioned in the center-right of the frame, with a bright, intense glow between them where they are in contact. The background is a dark, deep blue space filled with numerous small, distant stars.

Marten van Kerkwijk

Artwork from
Howell 2010,
Nature 463, 35

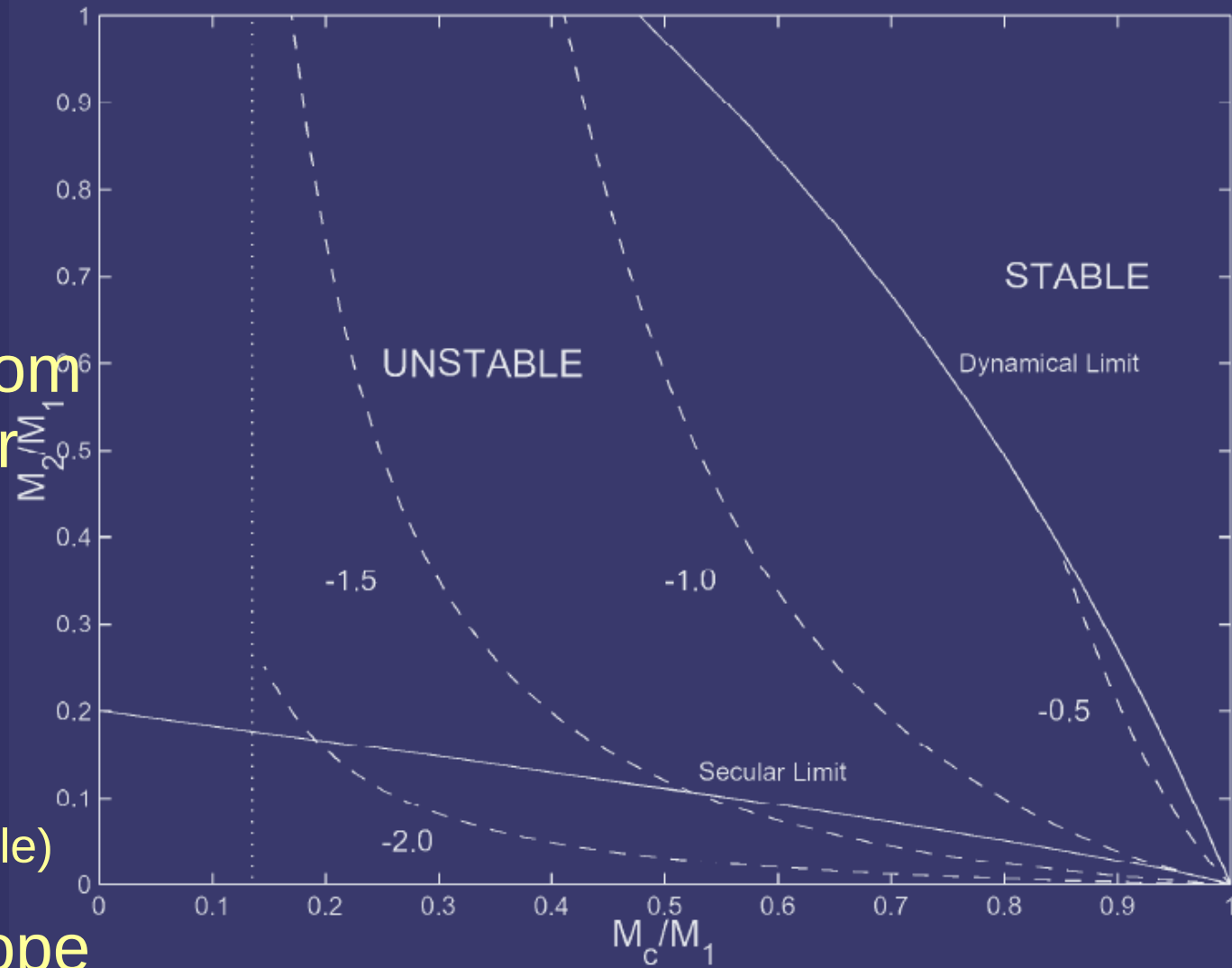
Radius evolution

- ★ Small expansion on MS
- ★ Much larger as red giant, esp. for low-mass stars.
- ★ Limited by superwind on AGB



Mass transfer

- ★ Mass transfer from heavier to lighter
⇒ orbit shrinks
- ★ Star mostly convective
⇒ star expands
(on dynamical timescale)
- ★ Common-envelope likely
- ★ Leads to many interesting, interacting sources
(CVs, LMXB, WD/NS/BH mergers, type Ia supernovae)

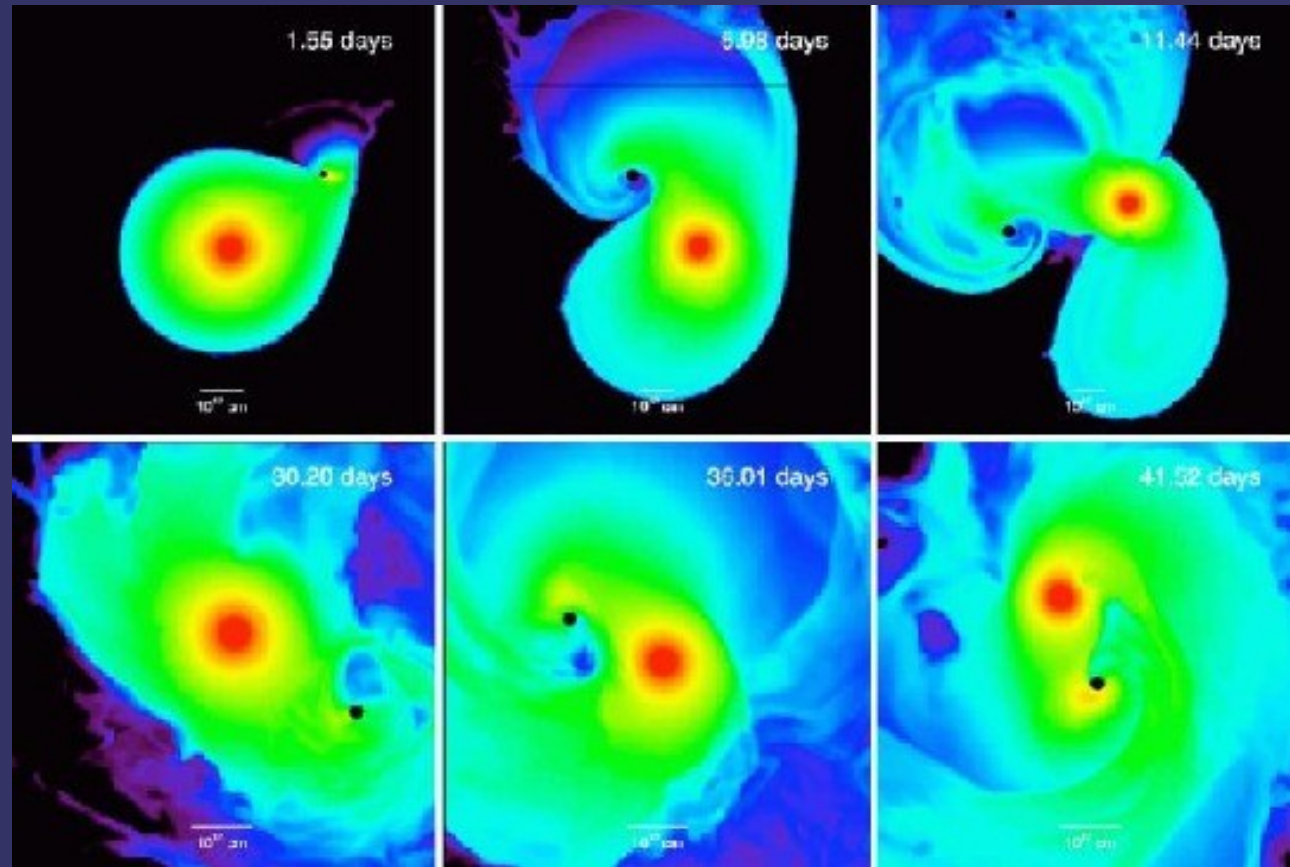


Common envelope

- ★ Can stop only when envelope is unbound.
- ★ Not clear when; usually, parametrised

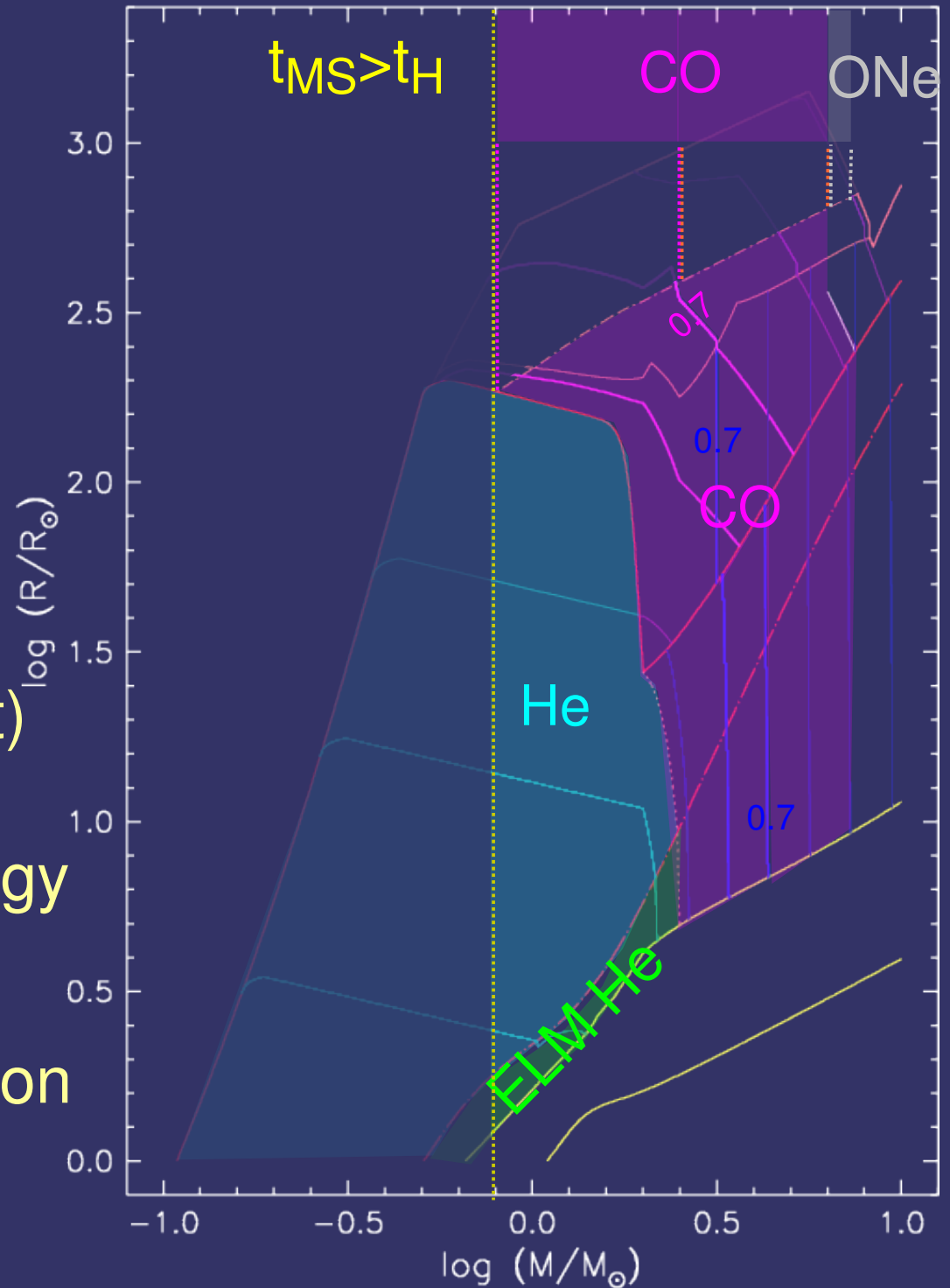
$$\alpha_{\text{CE}} \Delta E_{\text{orb}} = E_{\text{env}}$$

- ★ Currently, widely different values inferred; need better prescription? (Nelemans & Tout, 2005, MNRAS 356, 753)
- ★ Can we constrain this observationally?



Binary remnants

- ★ In interacting binaries,
0.8–1.8 M_{\odot} : He WD
(plus some CO from AGB)
1.8–~7 M_{\odot} : CO WD
- ★ W/ WD mass (He best)
⇒ know initial radius,
envelope binding energy
- ★ W/ companion mass
⇒ know initial separation
- ★ W/ present separation
⇒ know all!



Post-CE survey

- ★ Interesting sources: $a < 1$ AU
- ★ SDSS found ~ 1600 WD+MS binaries from colours/composite spectra;
(e.g., Rebassa-Mansergas et al., 2010, MNRAS 402, 620)
about 100 w/ $g < 17 \Rightarrow$ Typical distance ~ 100 pc.
RoboAO sensitive down to ~ 10 AU: good filter.
- ★ More interesting would be new candidates, say, from Galex/UV to nearby stars, or by targeting known He white dwarfs.
- ★ Complementary to finding WDs around normal stars from multiplicity survey