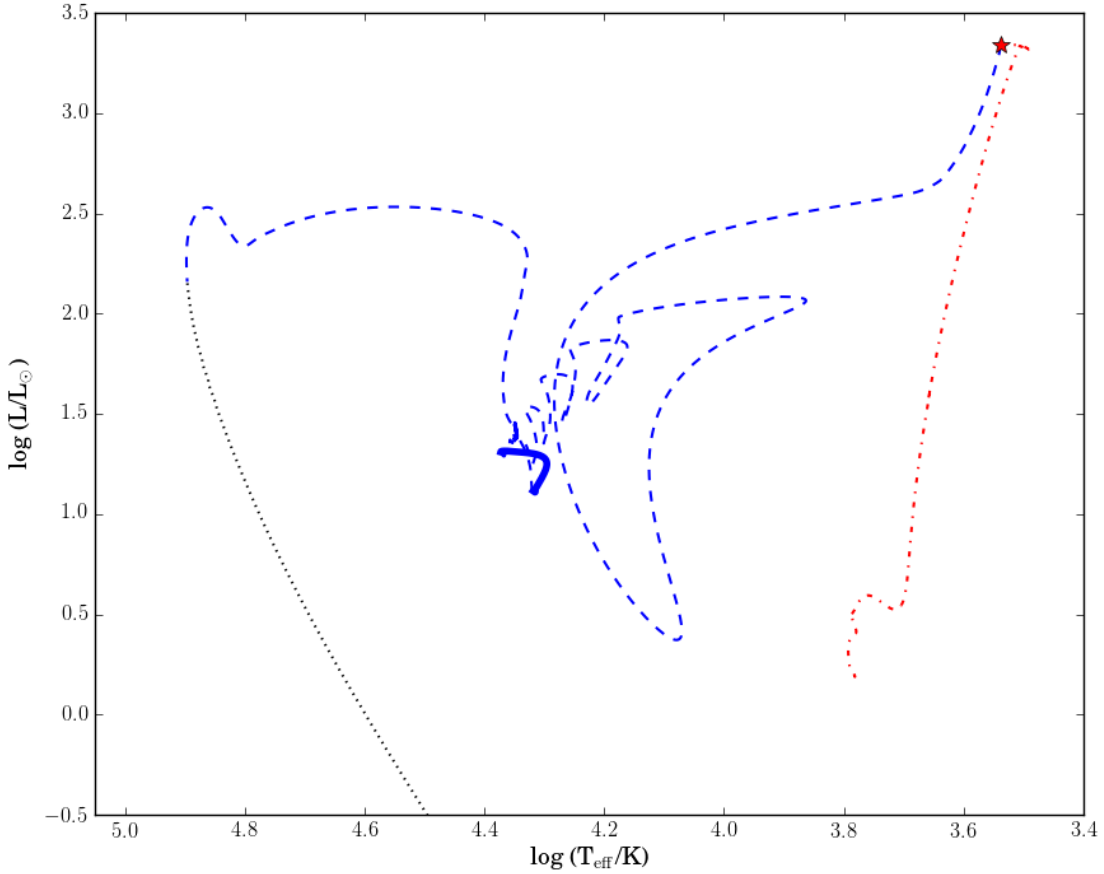
The eccentricity pumping effect of CB disks

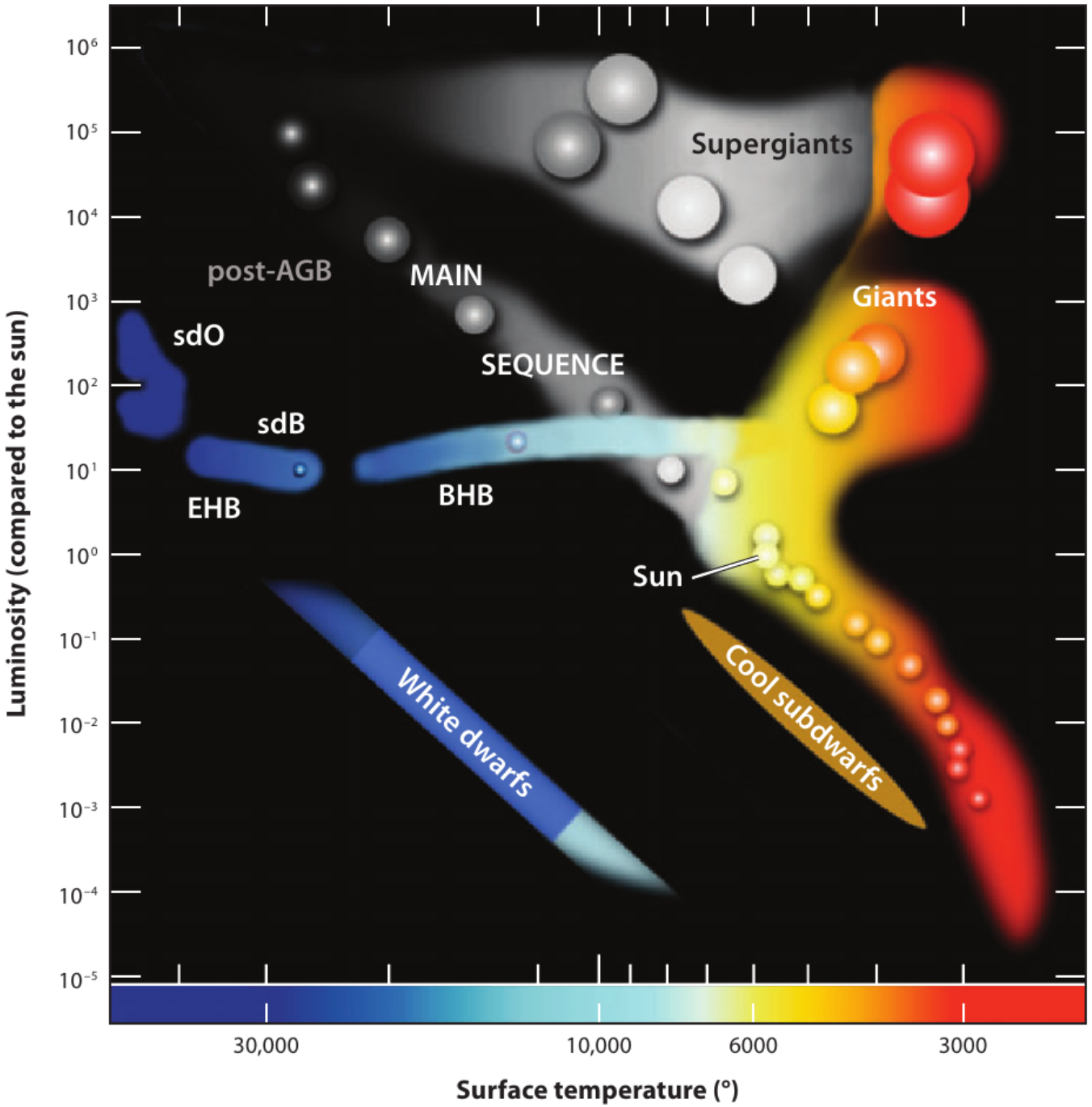


Joris Vos, Roy Oestensen, Pablo Marchant, Hans Van Winckel

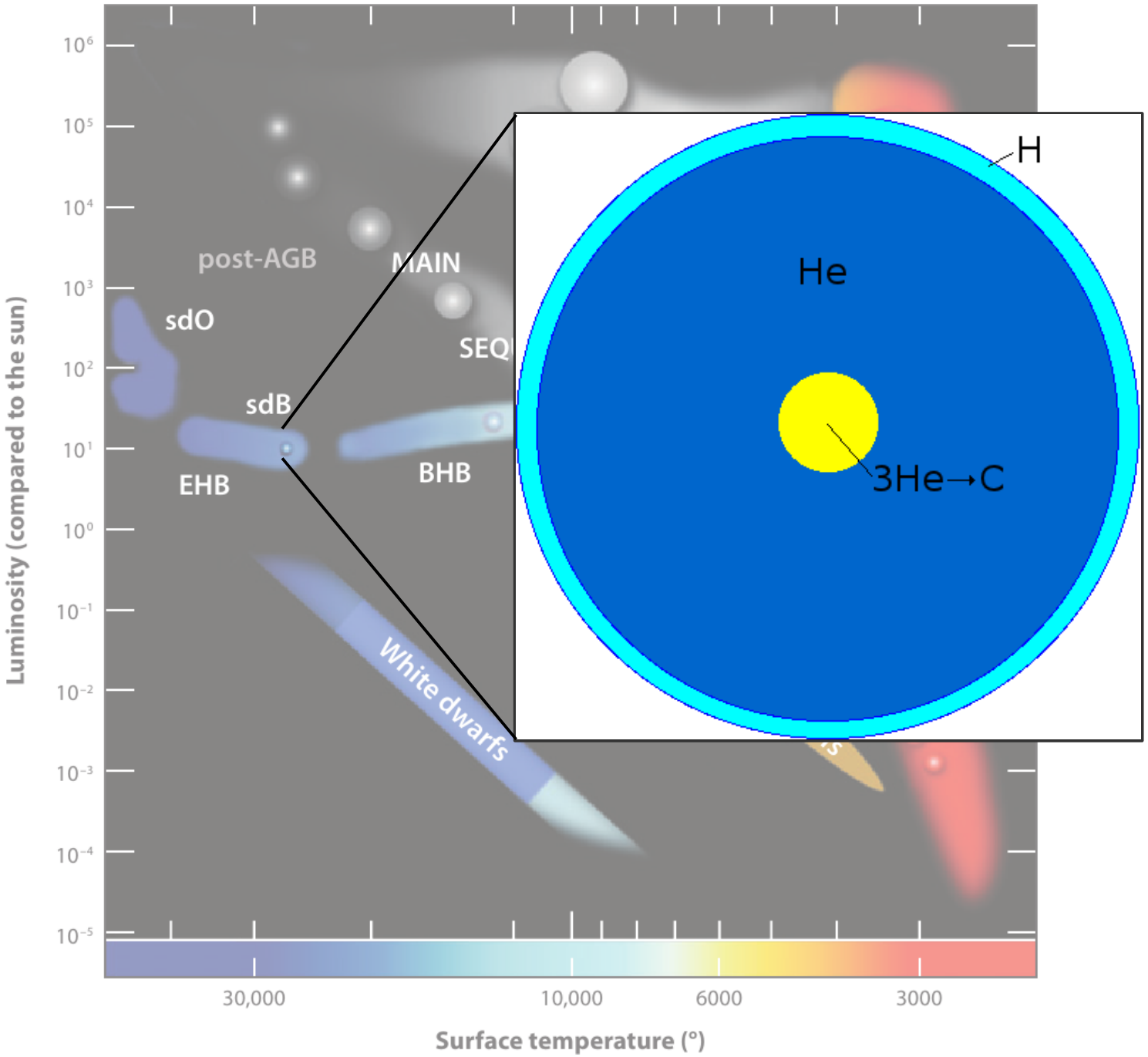
The Physics of Evolved Stars, 2015

KU LEUVEN

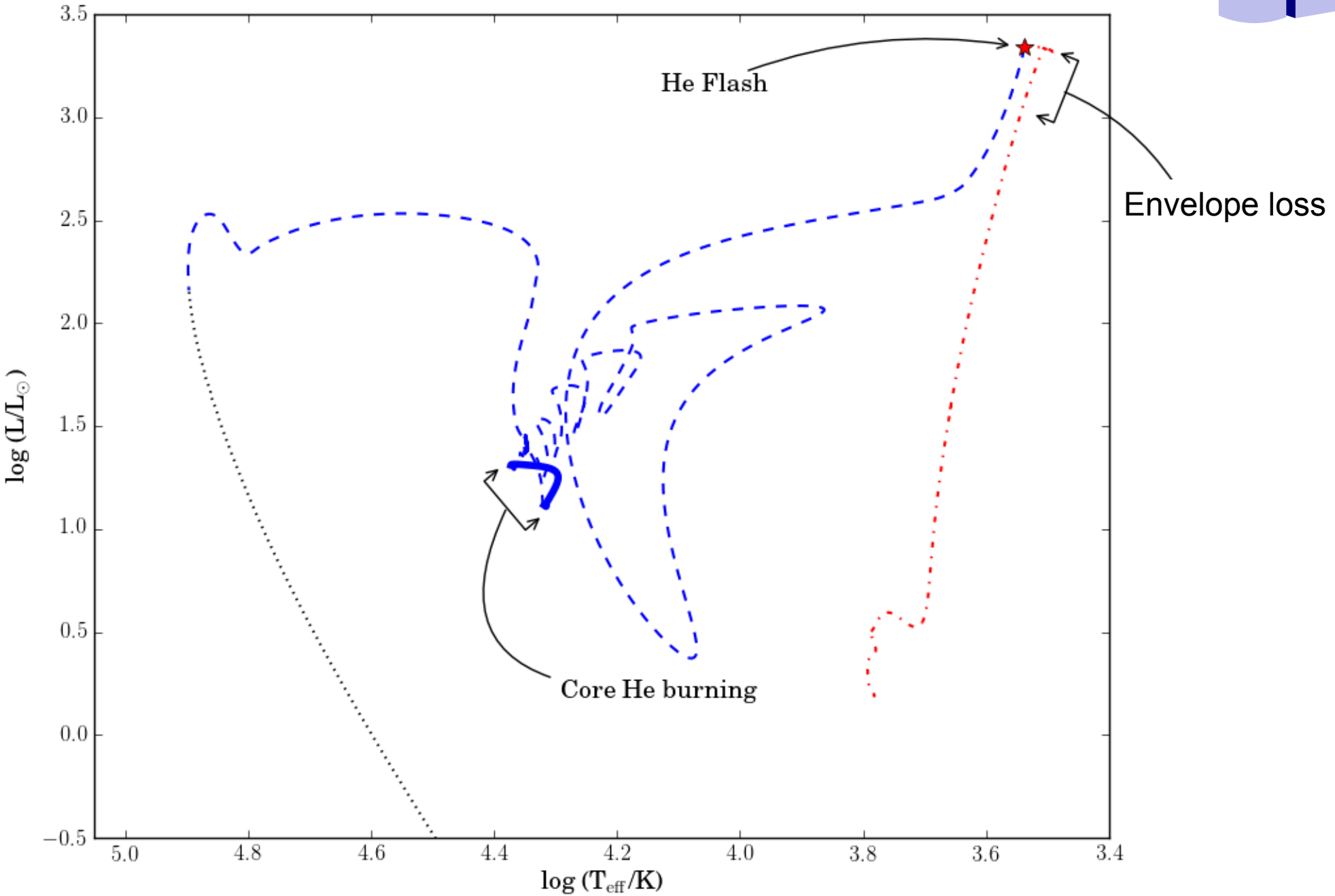
Hot subdwarfs



Hot subdwarfs



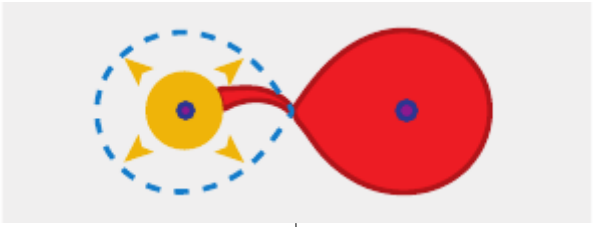
Hot subdwarf evolution



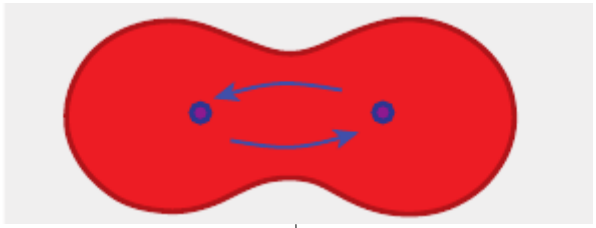
sdB formation

RG + MS Binary

Unstable RLOF

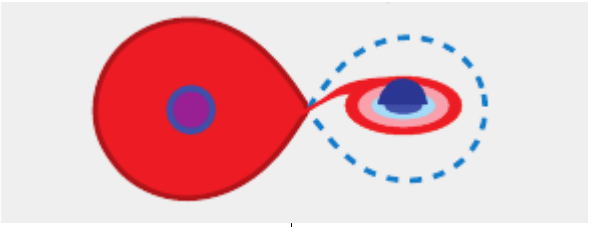


Common Envelope



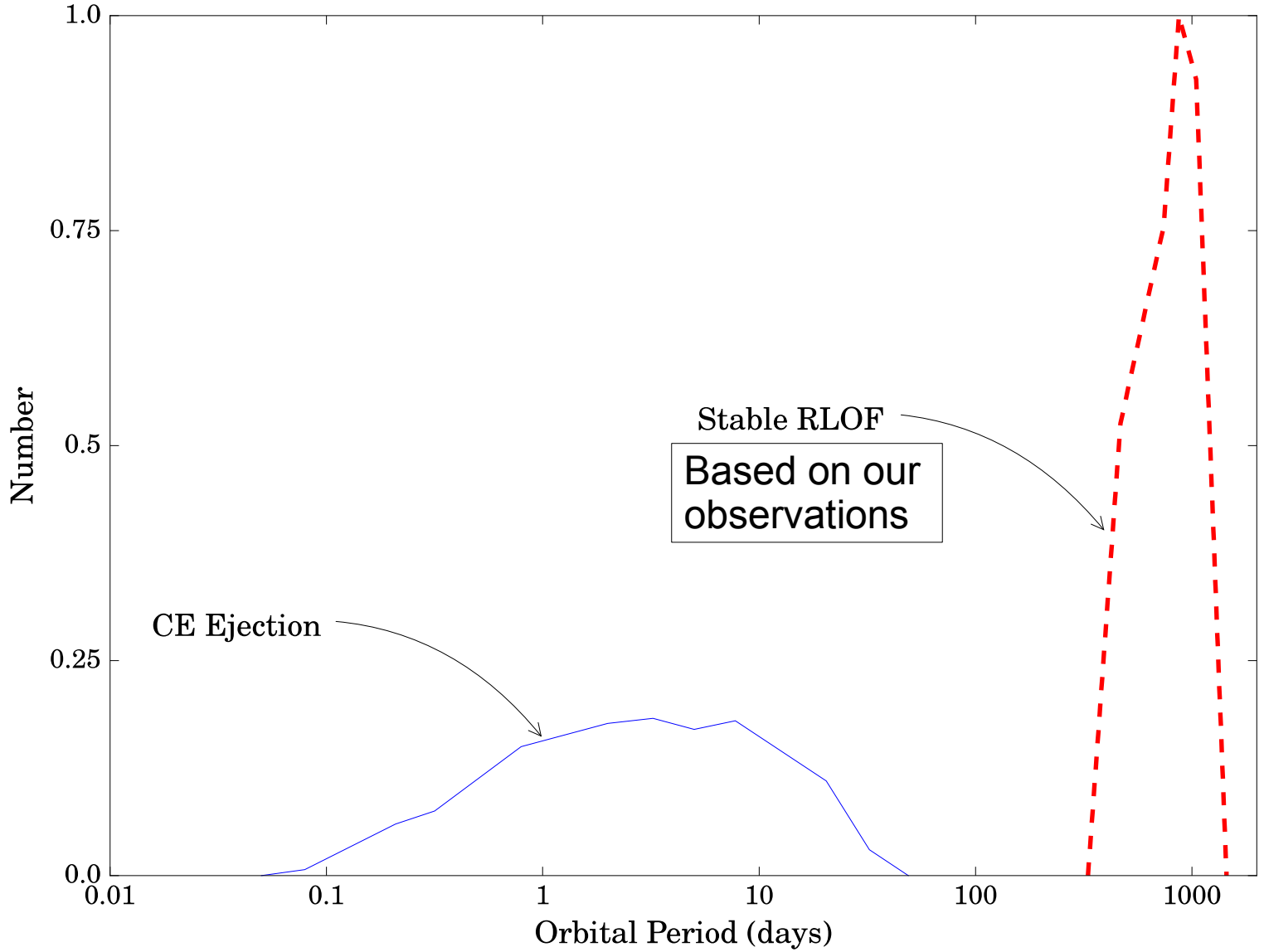
Short period

Stable RLOF



Long period

Theoretical predictions



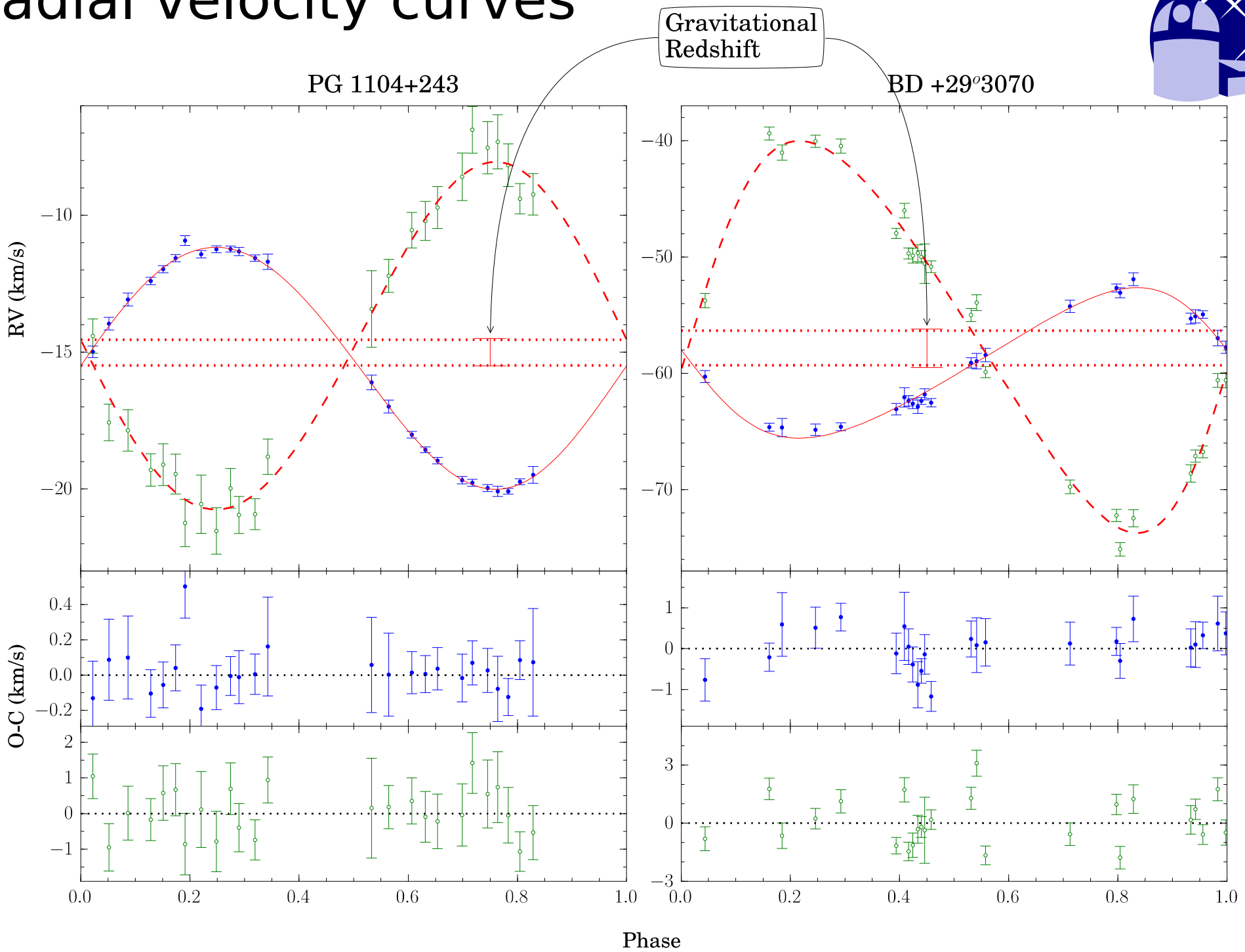
Adapted from Han et al. 2003; Chen et al 2013

sdB observing campain

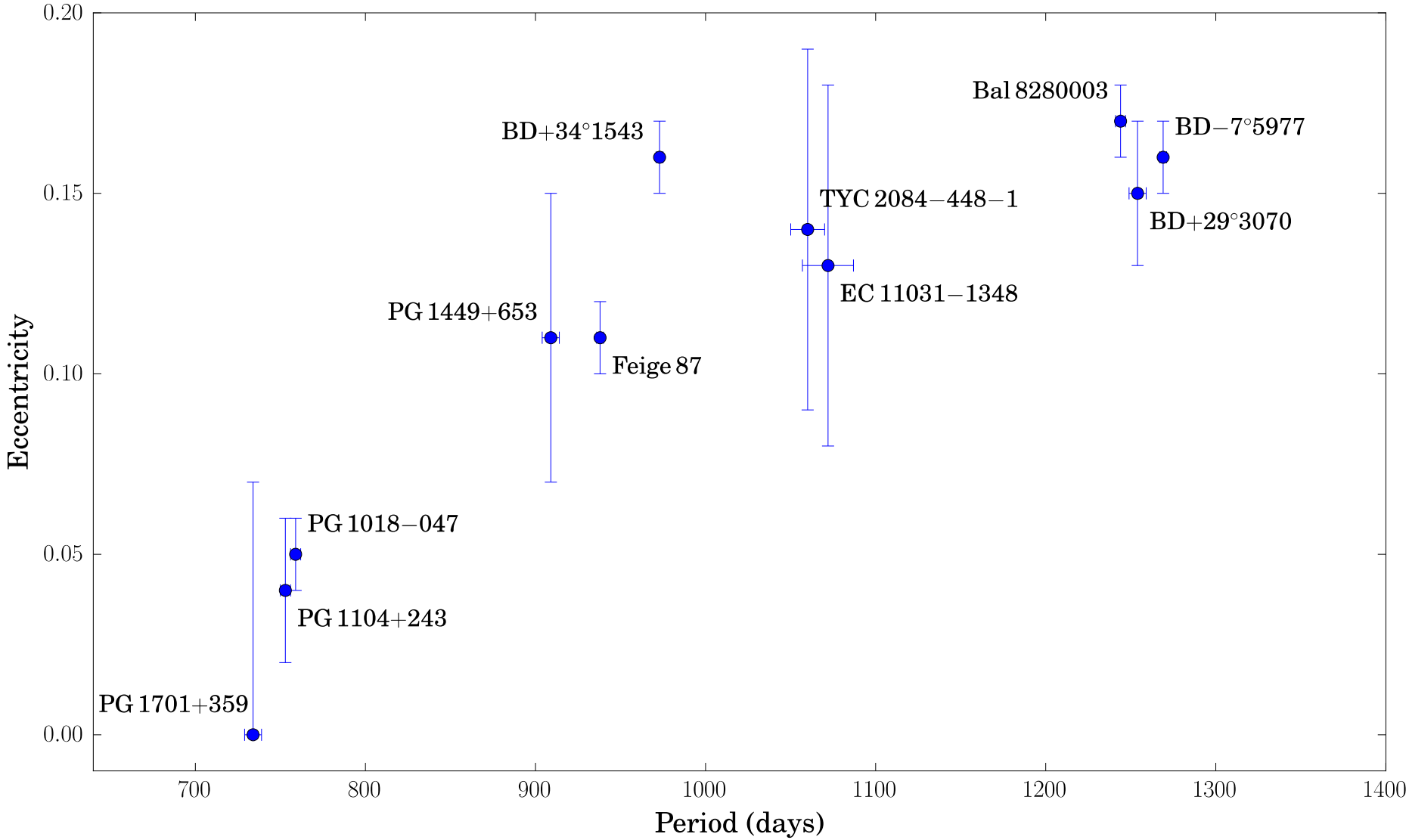
HERMES @ Mercator

- 8 targets
- 6 years of monitoring
- ~50 spectra/target

Radial velocity curves



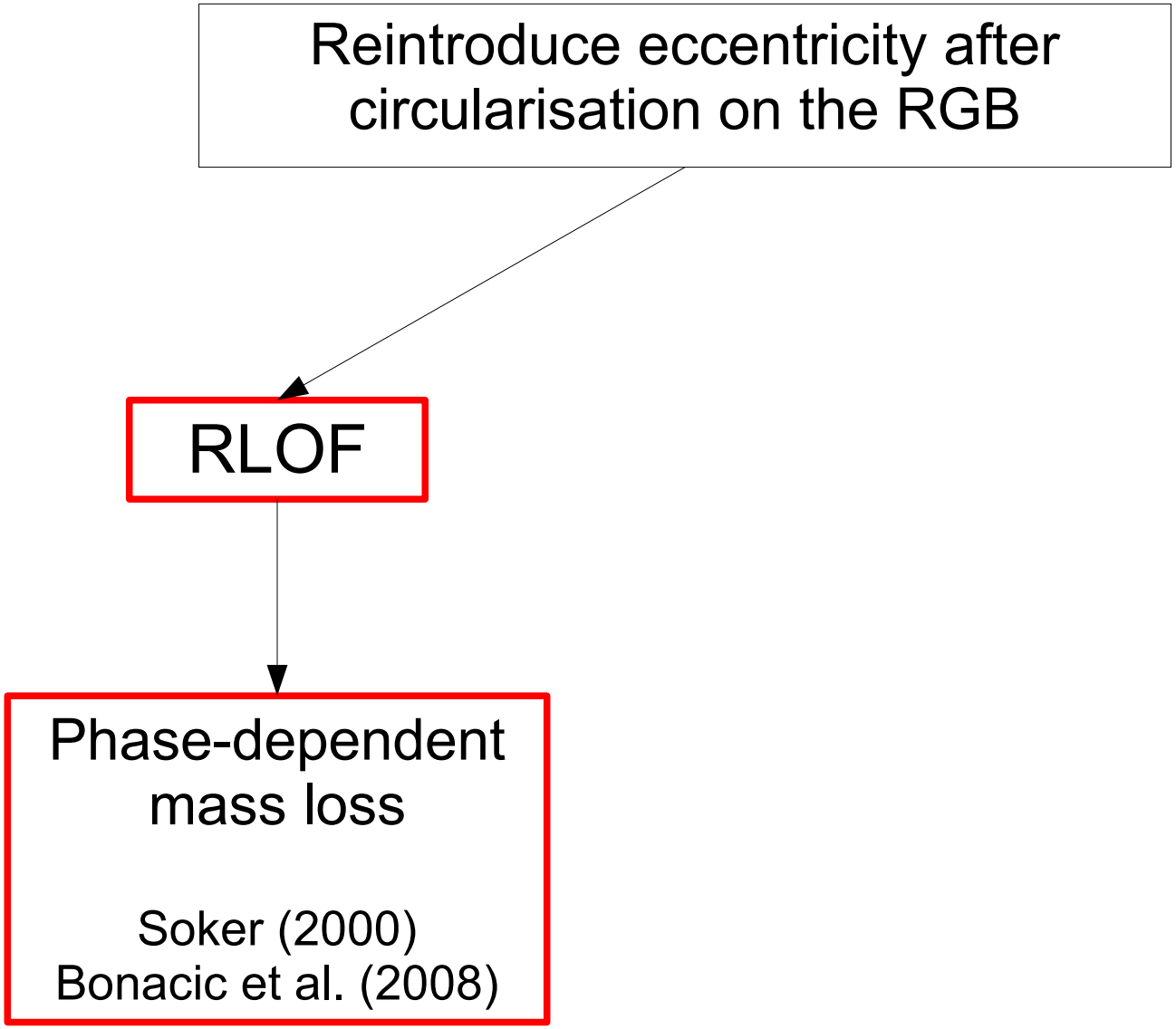
Unexpected eccentricity



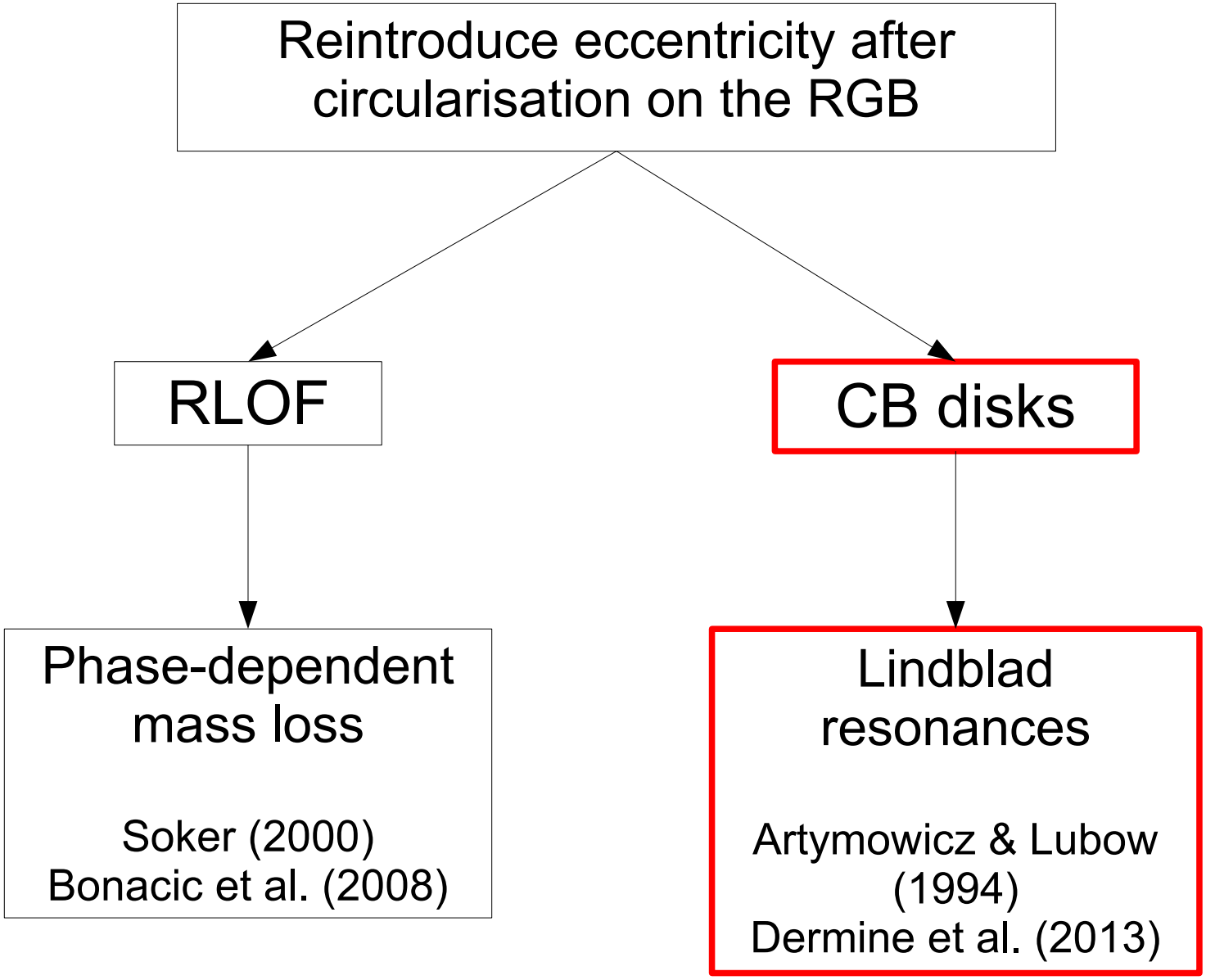
Eccentricity Pumping

Reintroduce eccentricity after circularisation on the RGB

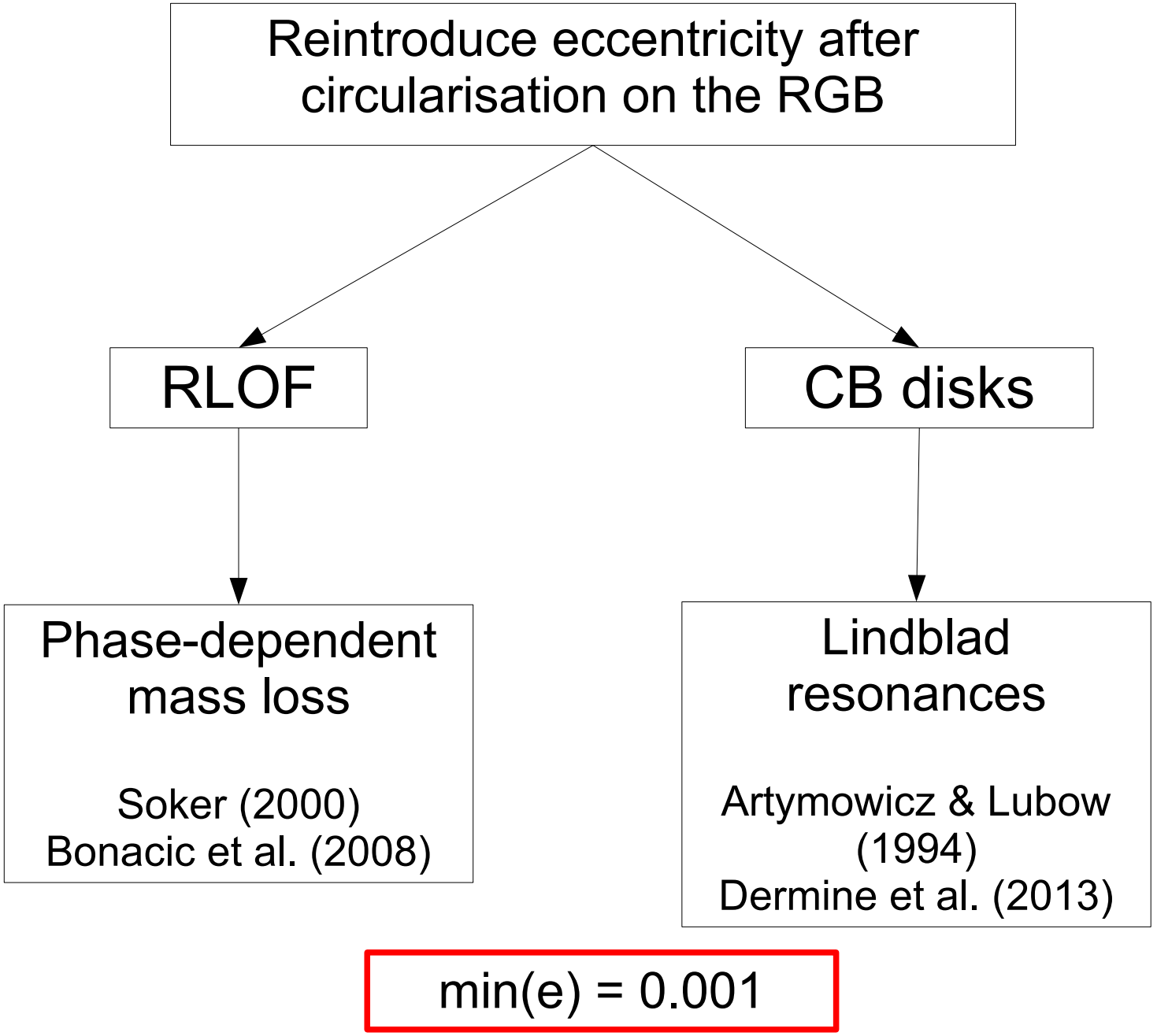
Eccentricity Pumping



Eccentricity Pumping



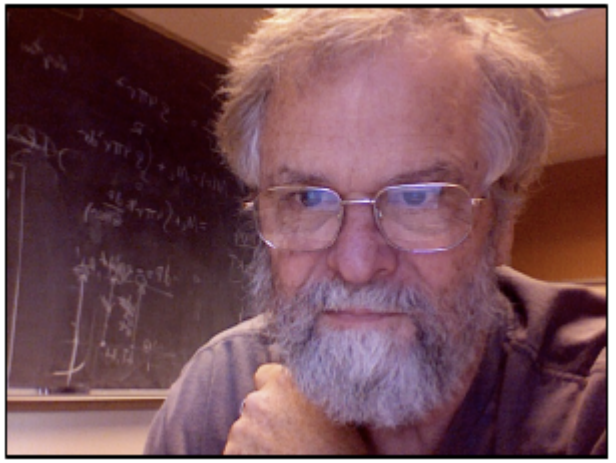
Eccentricity Pumping



MESA

Modules for Experiments in Stellar Astrophysics

MESA is a state-of-the-art, modular, open source suite for stellar evolution



Bill Paxton, father of MESA

- MESA stellar evolution code: mesa.sourceforge.net
- MESA instrument papers (Paxton et al. 2011, 2013)

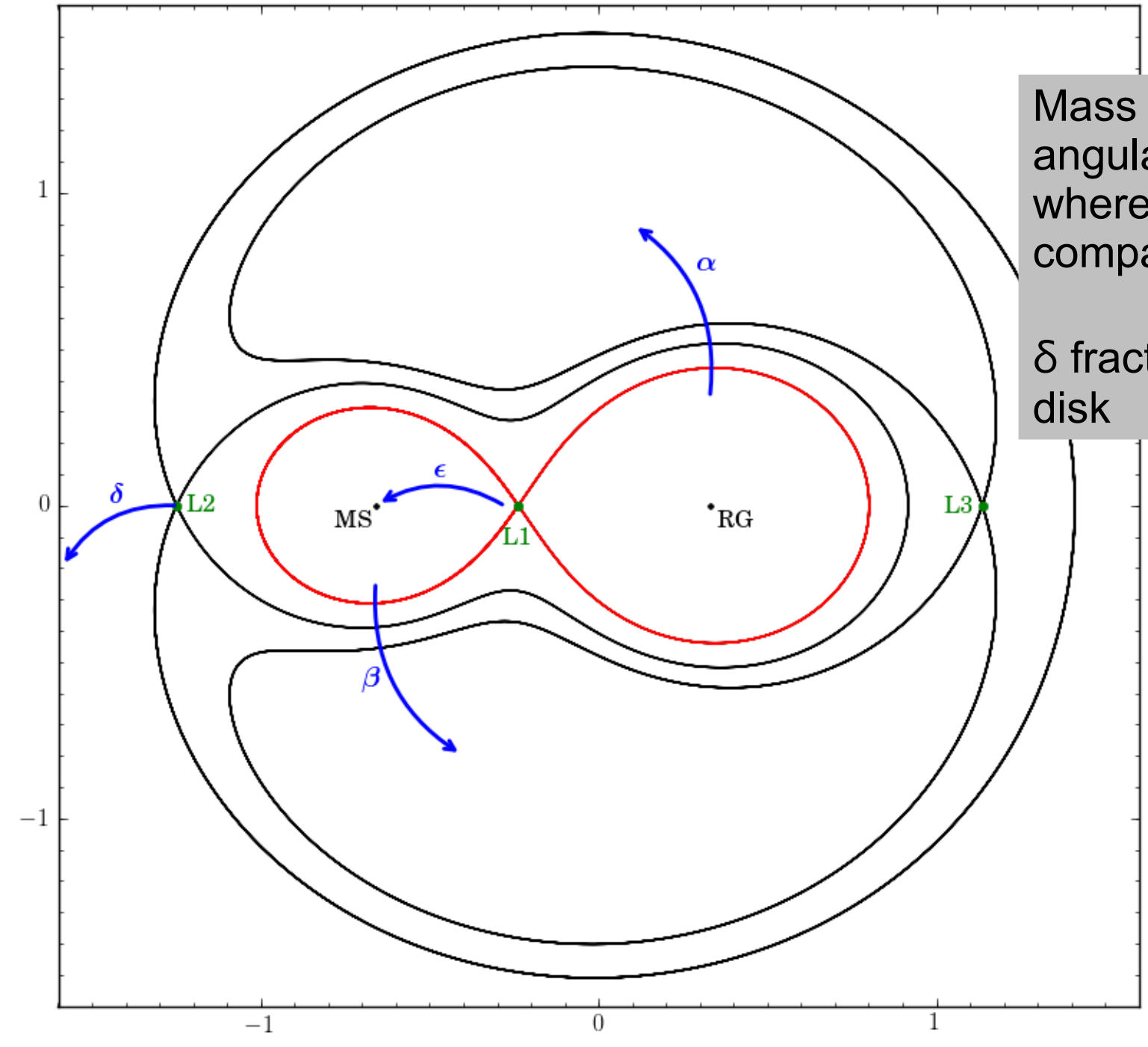
MESA

Modules for Experiments in Stellar Astrophysics

Binary Module

- 2 stars evolved at the same time
- Implicit mass transfer (Ritter & Kolb)
- Tides (Zahn 1977)
- Circularisation (Hut 1981, Zahn 1988)
- Magnetic braking
- Gravitational waves
- Angular momentum accretion

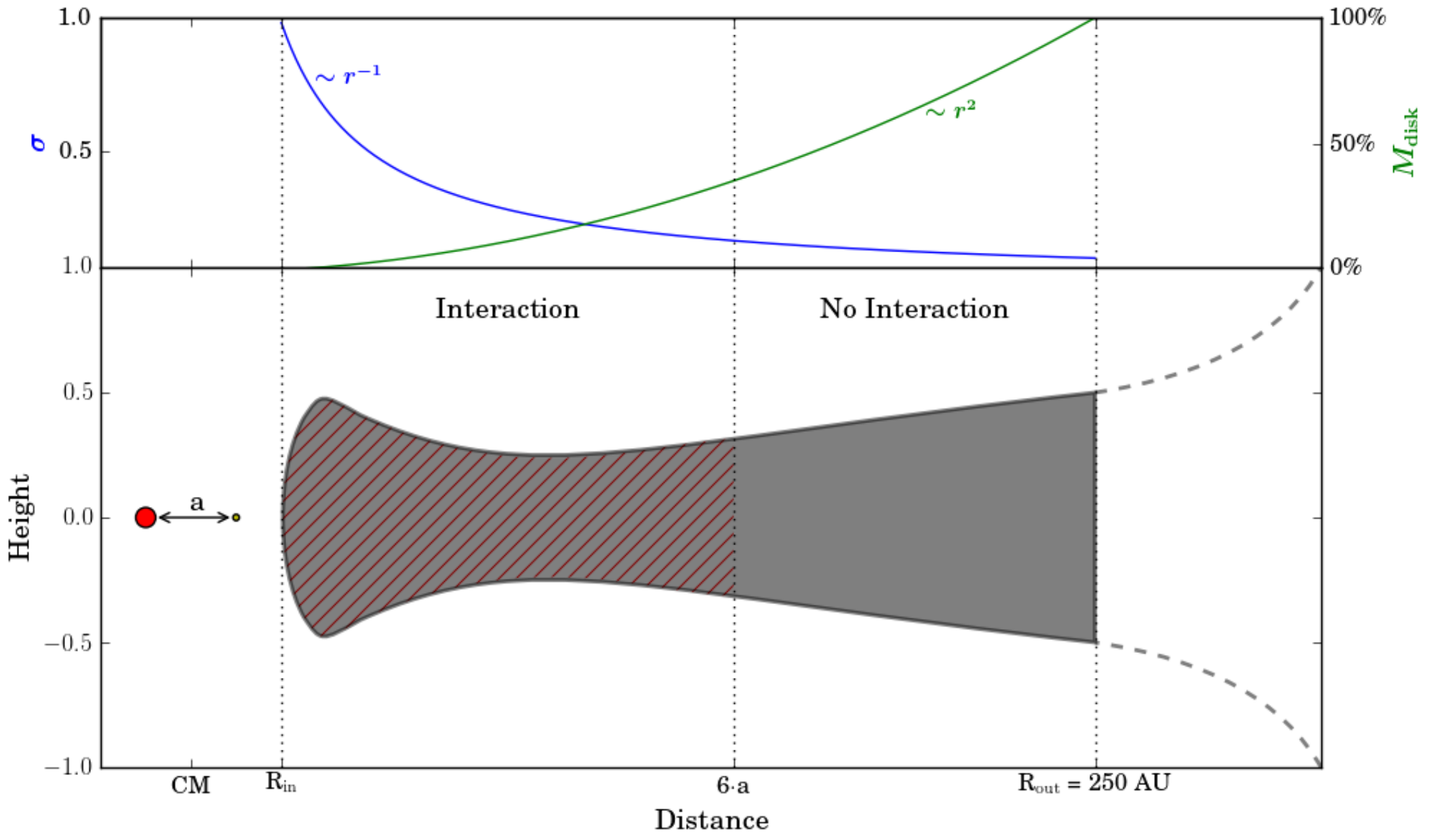
RLOF mass-loss fractions



Mass takes away the angular momentum from where it is lost: donor, companion or L2

δ fraction feeds the CB disk

Circumbinary Disk parameters



Circumbinary Disk edot

Eccentricity pumping depends on the orbital eccentricity

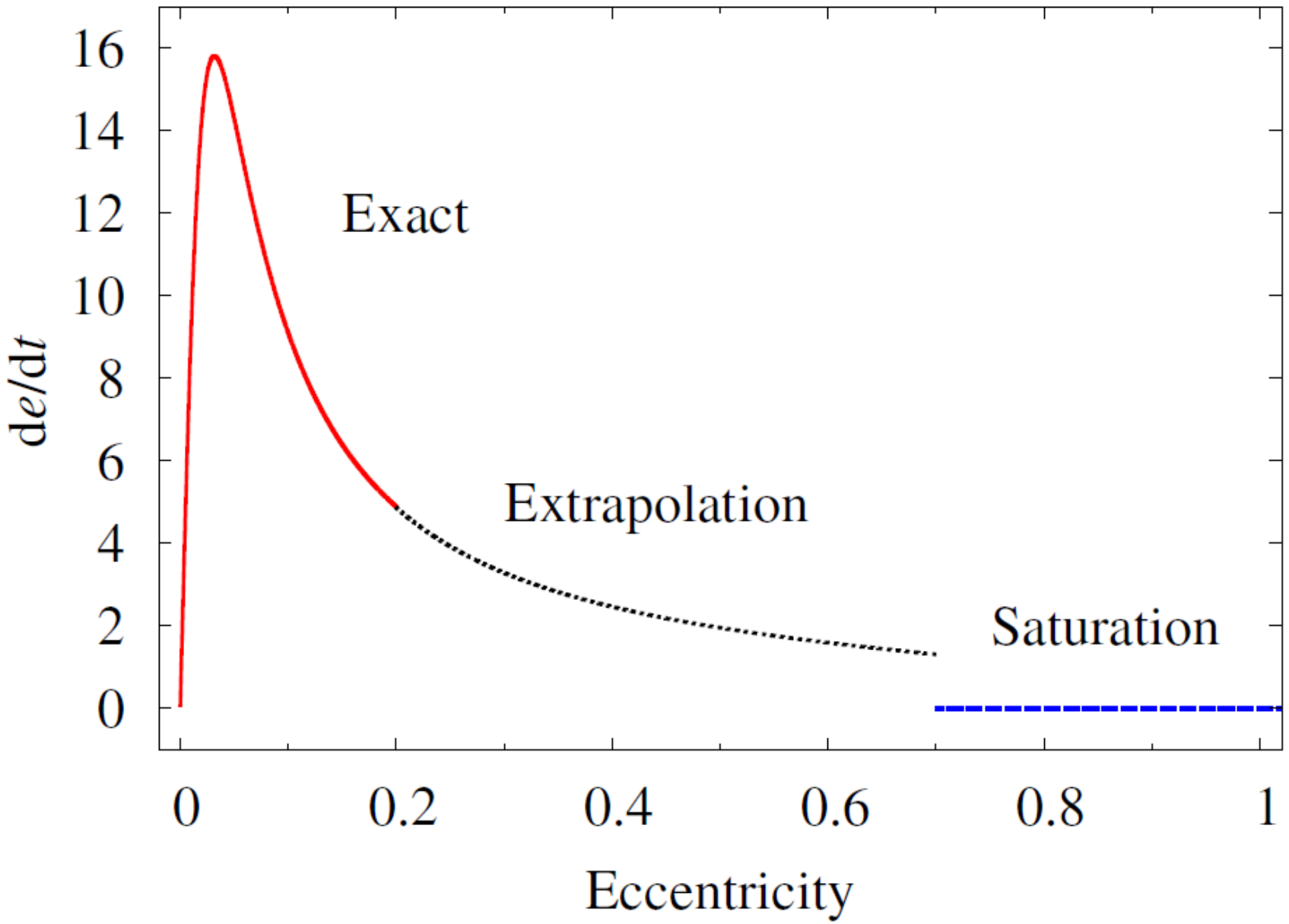
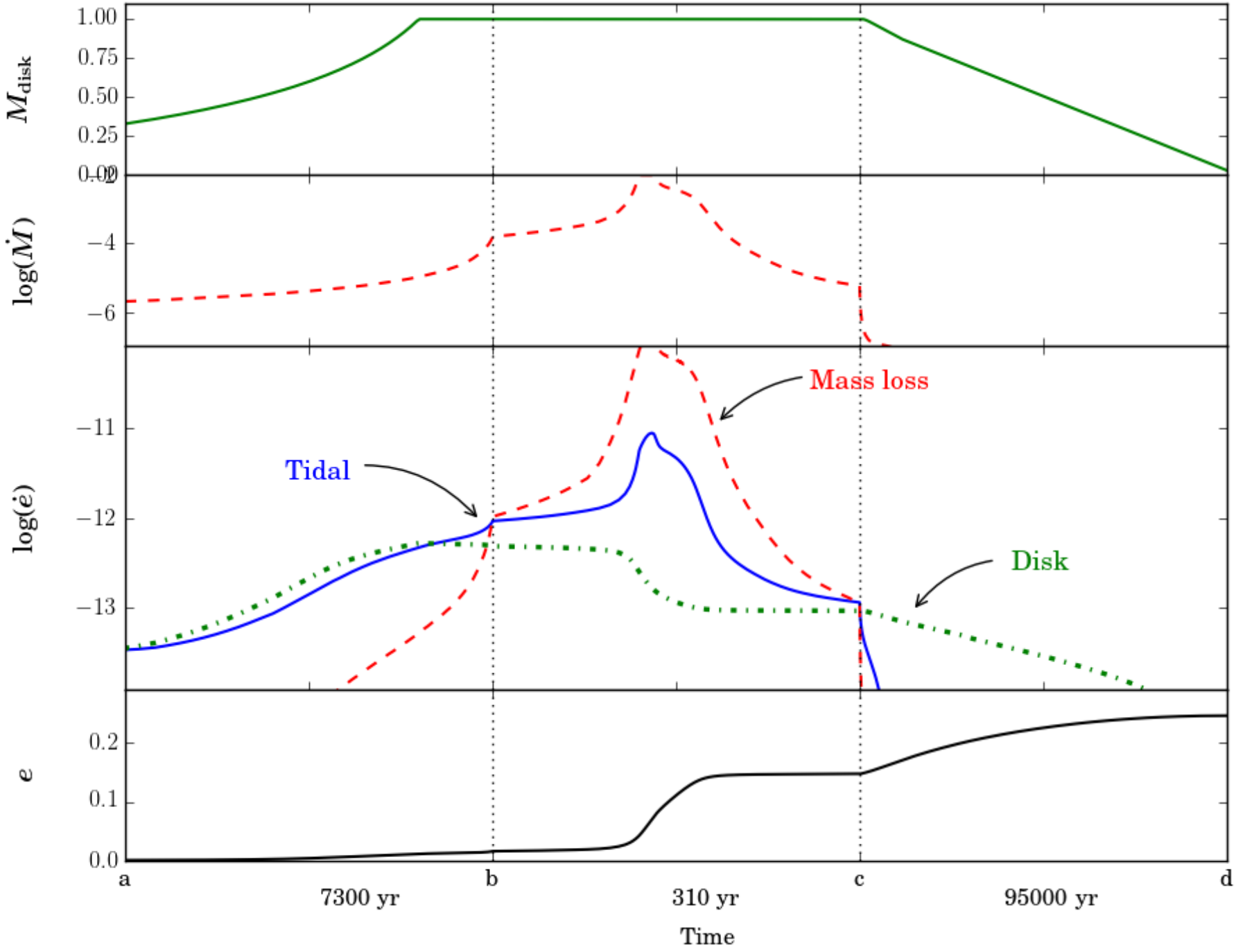
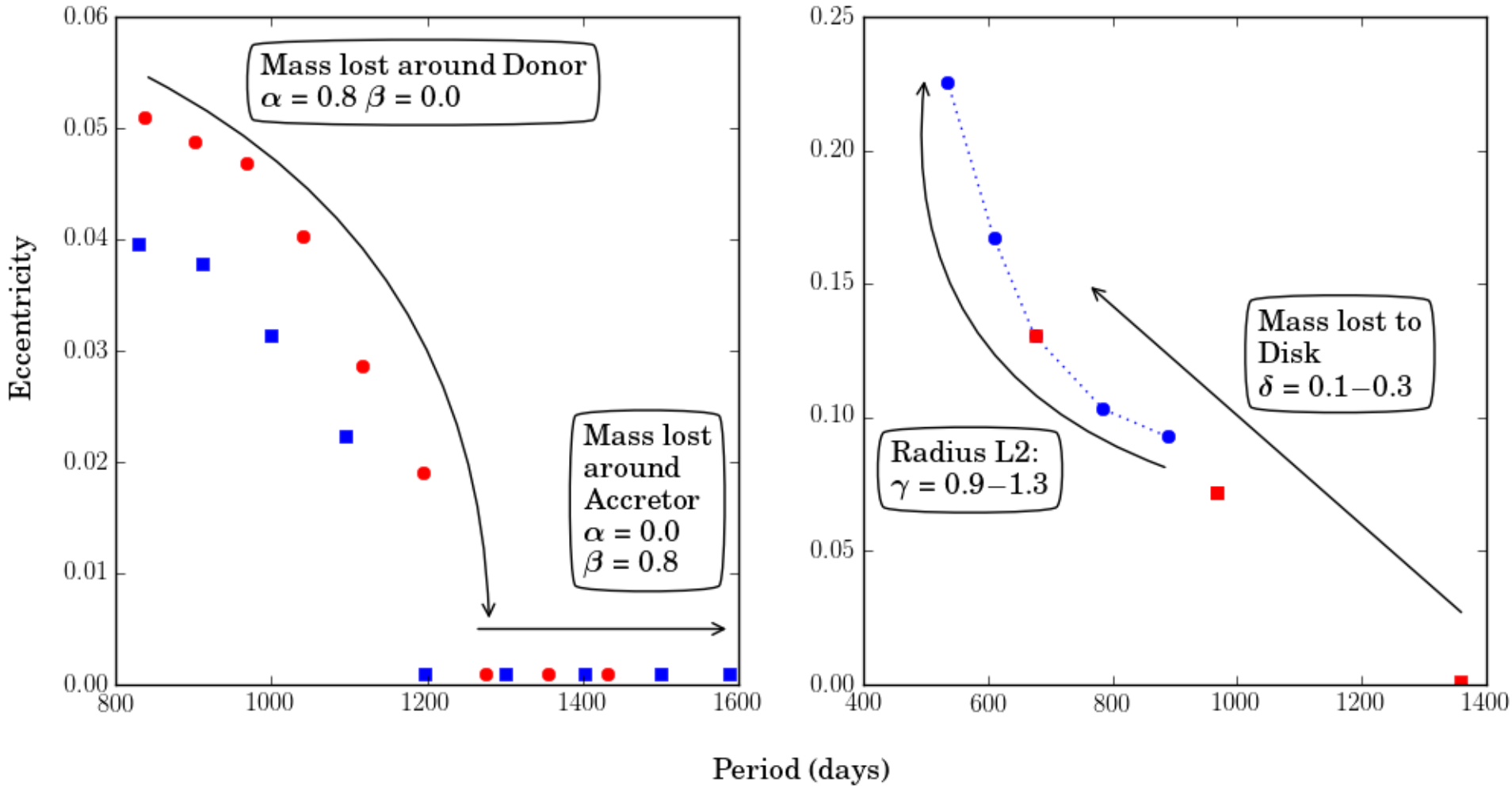


Figure taken from Dermine et al. 2013

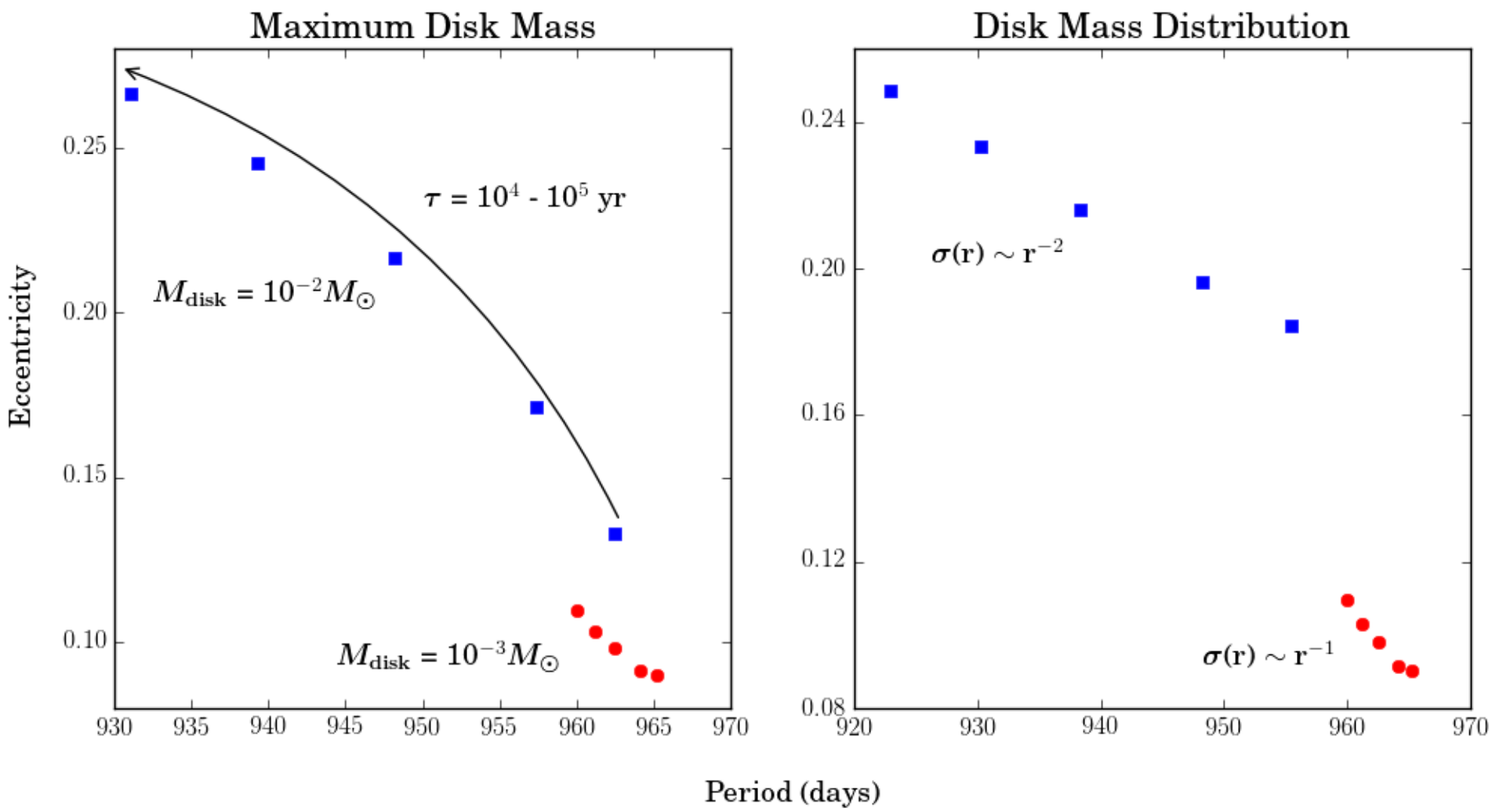
Eccentricity evolution



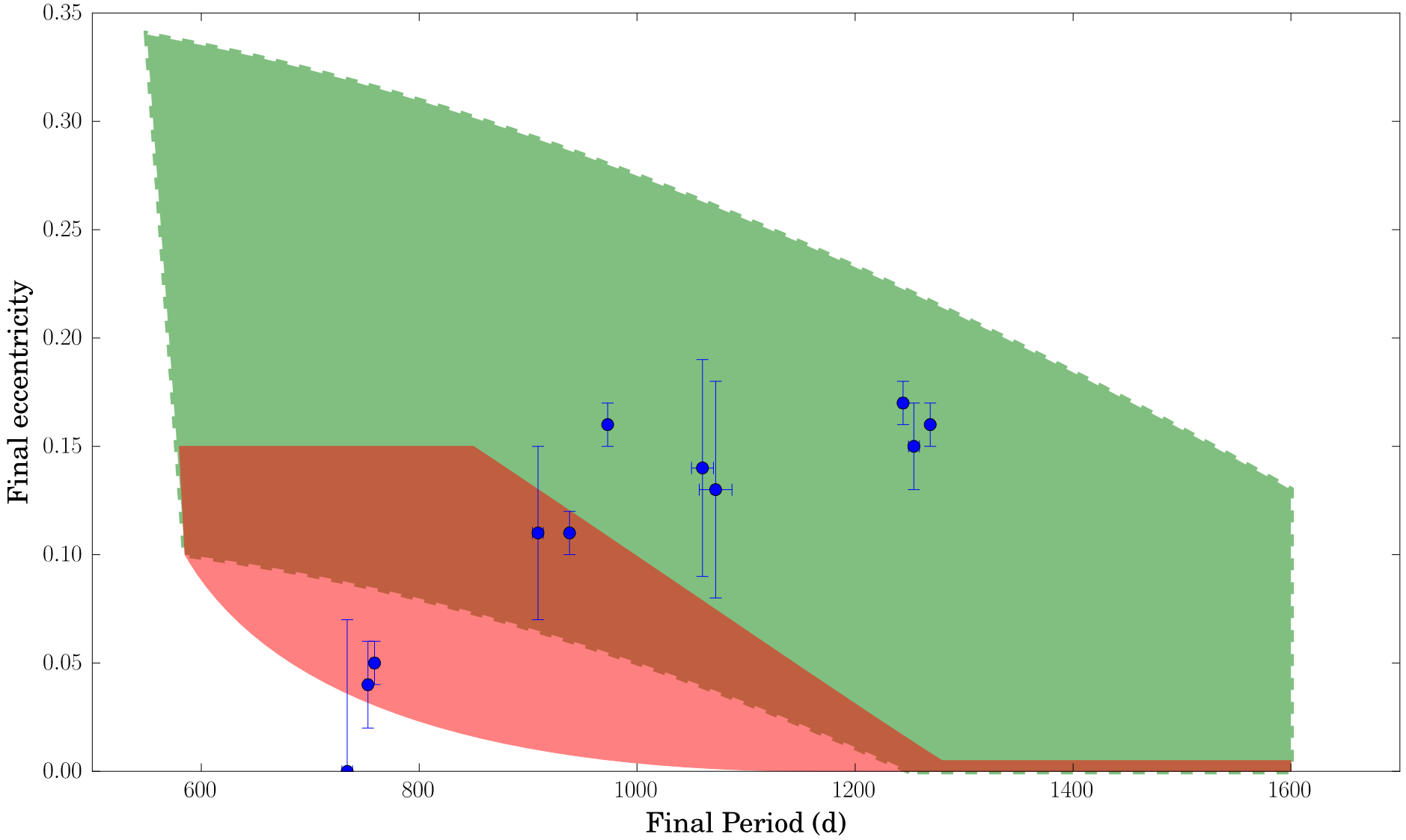
Parameter Effect - RLOF



Parameter Effect – CB disk



Period – Eccentricity Disk & RLOF



Results & Conclusions

Created a small test sample for binary interaction mechanisms

MESA

Models allow for observed systems, but don't predict them.

Future prospects:

- Connection to He-WD and dust post-RGB binaries
- Population synthesis studies
- Search for evidence for CB disks