Interactions of supernovae with the surrounding circumstellar medium

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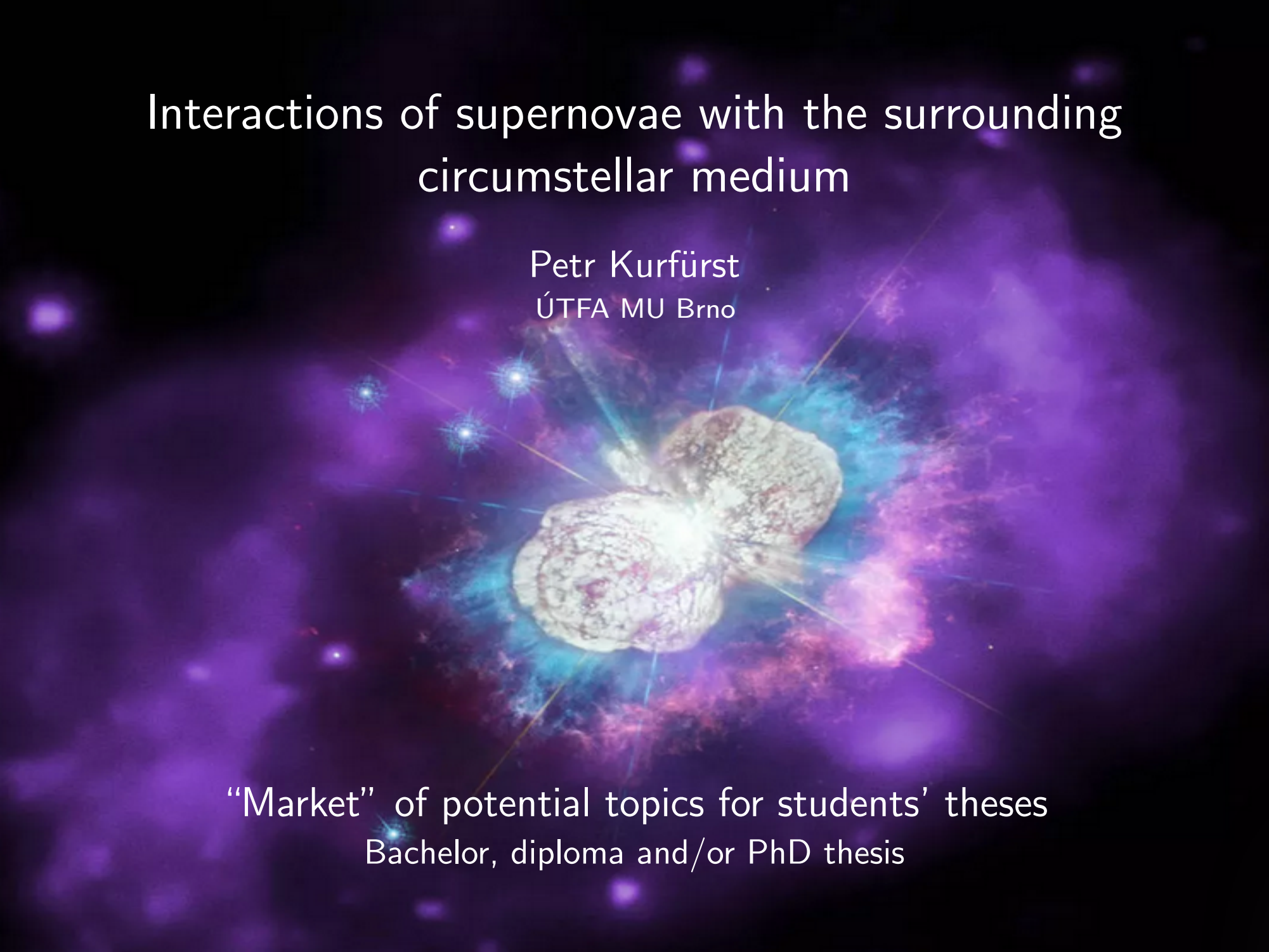
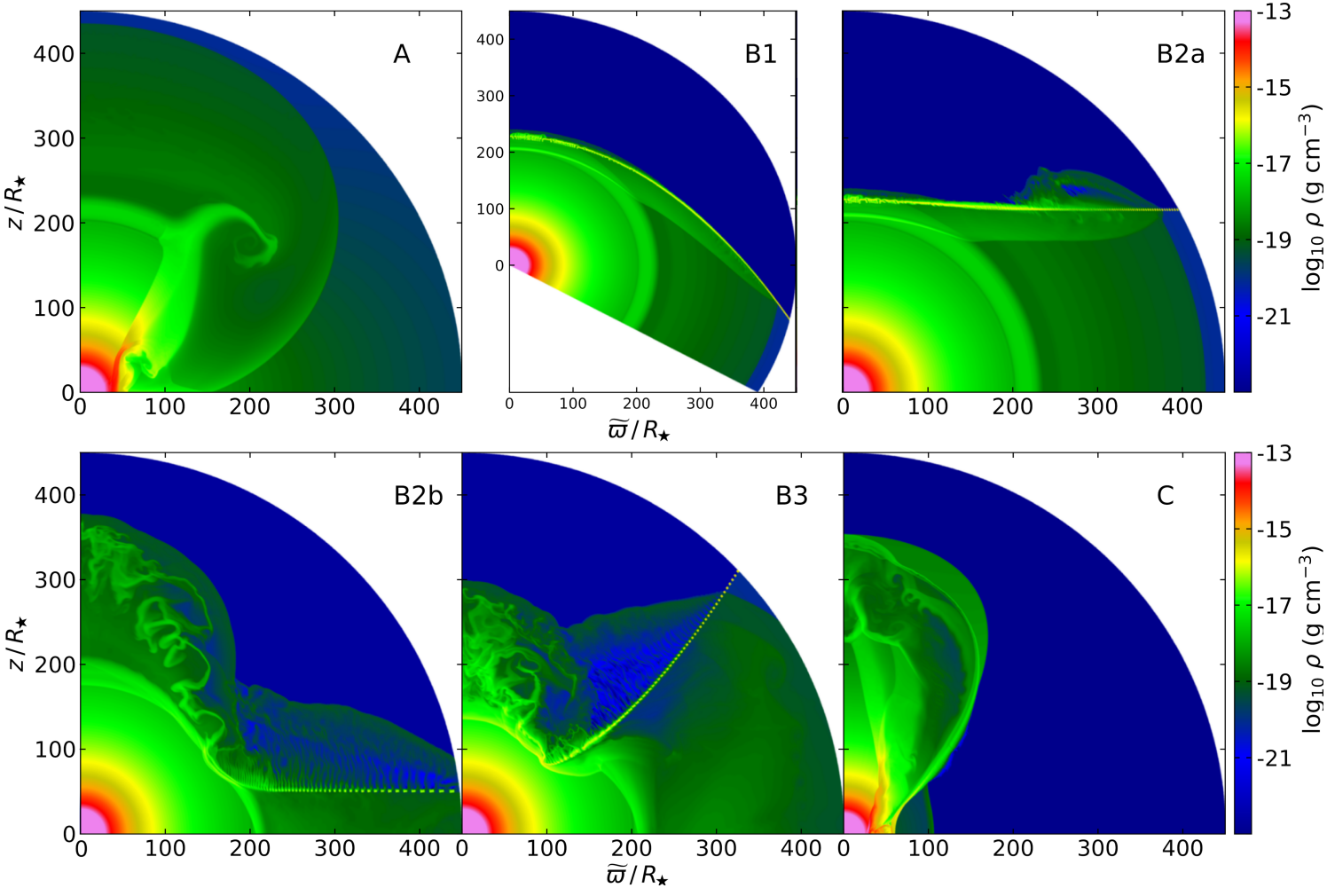


"Market" of potential topics for students' theses

Bachelor, diploma and/or PhD thesis

Hydrodynamics of interaction

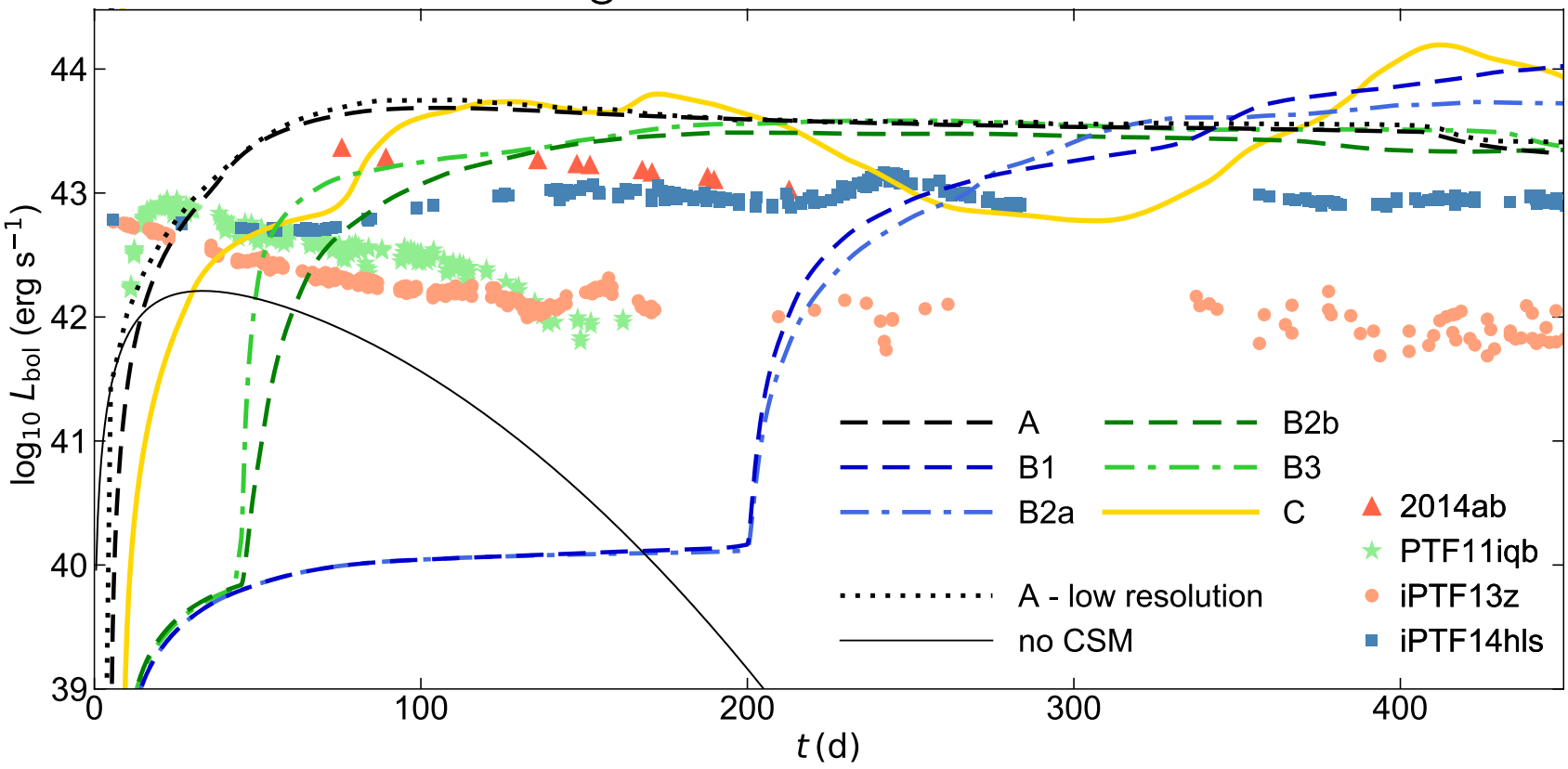
- Hydrodynamic simulations of a supernova (SN) interacting with various forms of aspherical circumstellar medium



- Using the own Eulerian hydrodynamic code (Kurfürst+ 2020) or other widely used hd codes (SNEC, Flash, Athena+, etc.)

Shock power as an internal power source

Estimates of light curves from our simulations:



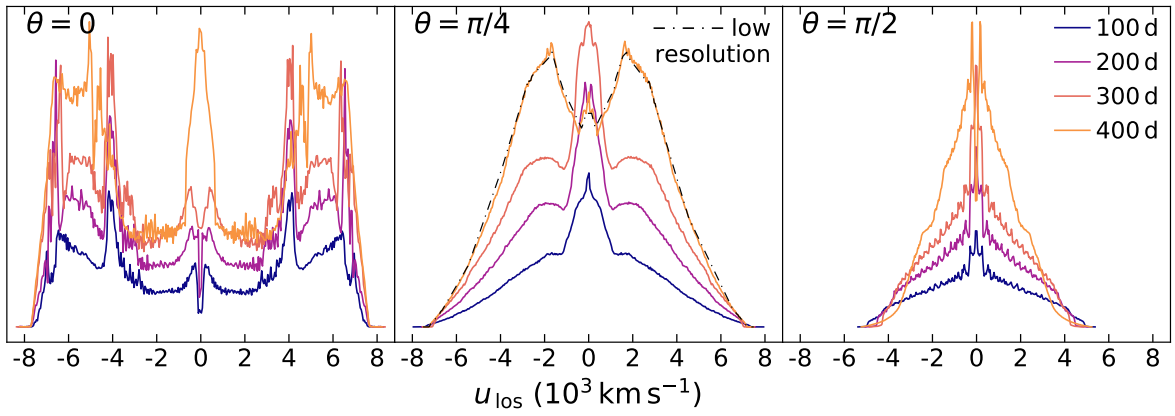
Compared to observed LCs (Bilinski+ 2020, Smith+ 2015, Nyholm+ 2017, Arcavi+ 2017)

- A - SN-disk
- B1 - SN-concave colliding wind (CW) shell
- B2a - SN-distant planar CW shell
- B2b - SN-closer planar CW shell
- B3 - SN-convex CW shell
- C - SN-bipolar lobes

Spectral line profiles

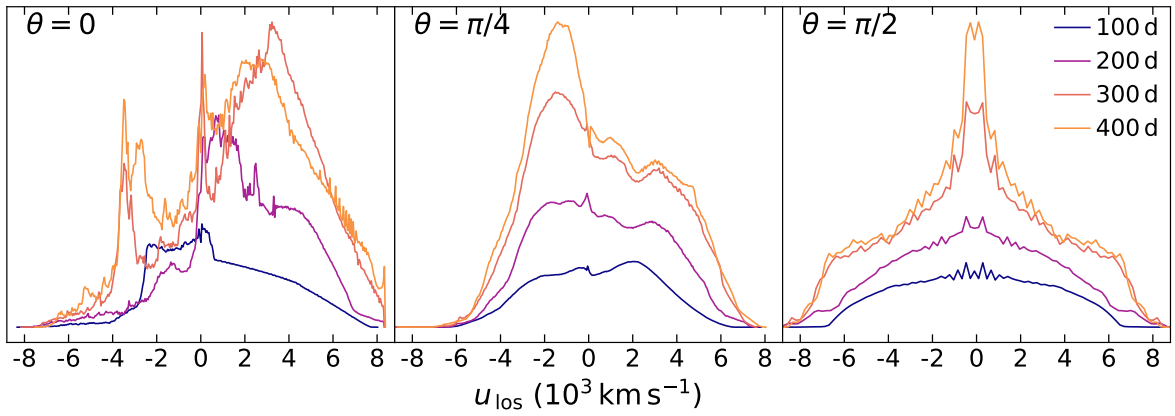
- Different viewing angles correspond to different line-of-sight velocity distributions:

A



SN - disk

B2b



SN - colliding winds planar shell

- Modeling of spectra using radiation transfer or Monte Carlo computational codes (RADMC-3D, Cloudy, etc.)

Models of magnetospheres of rotating hot stars

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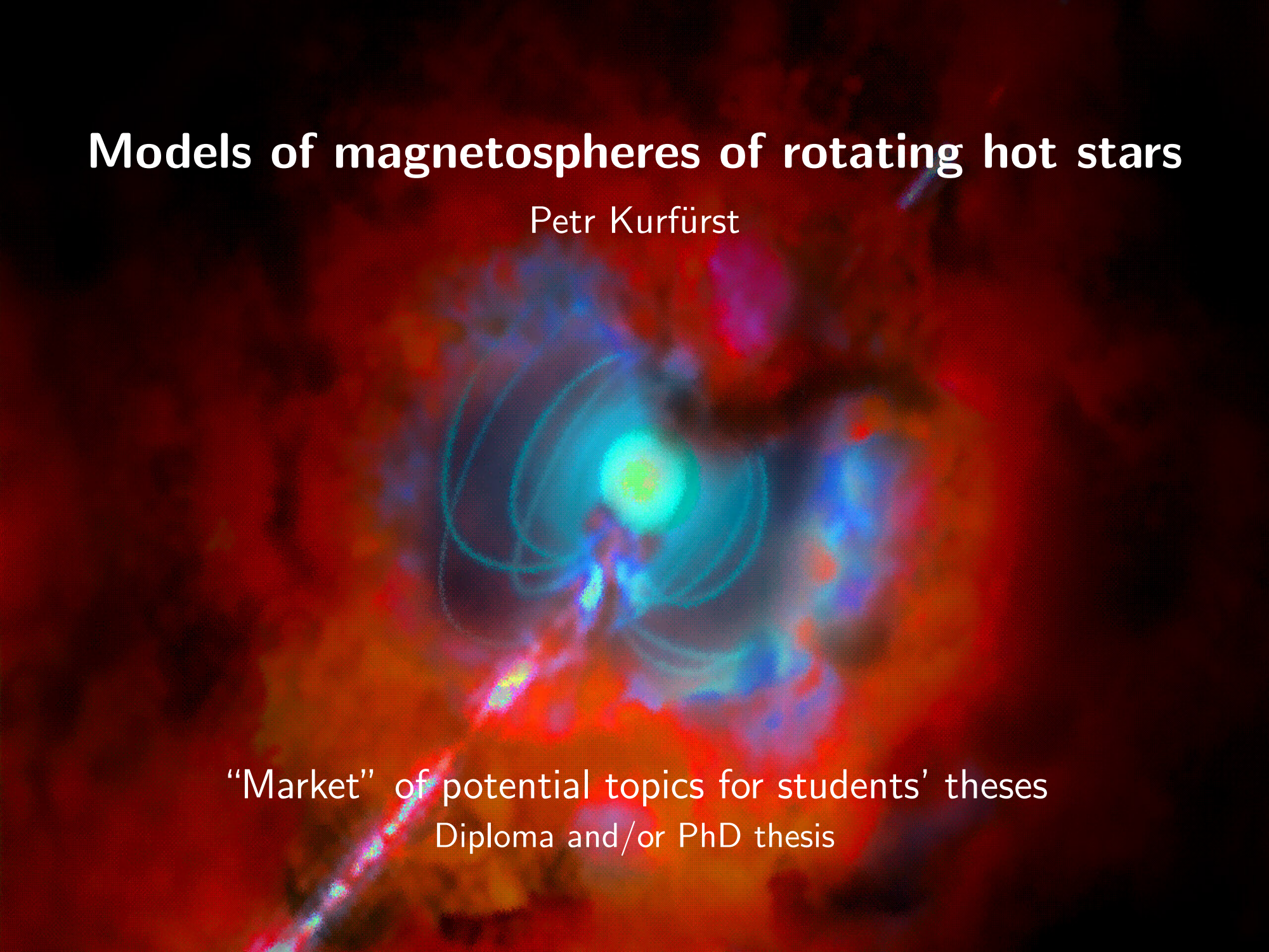
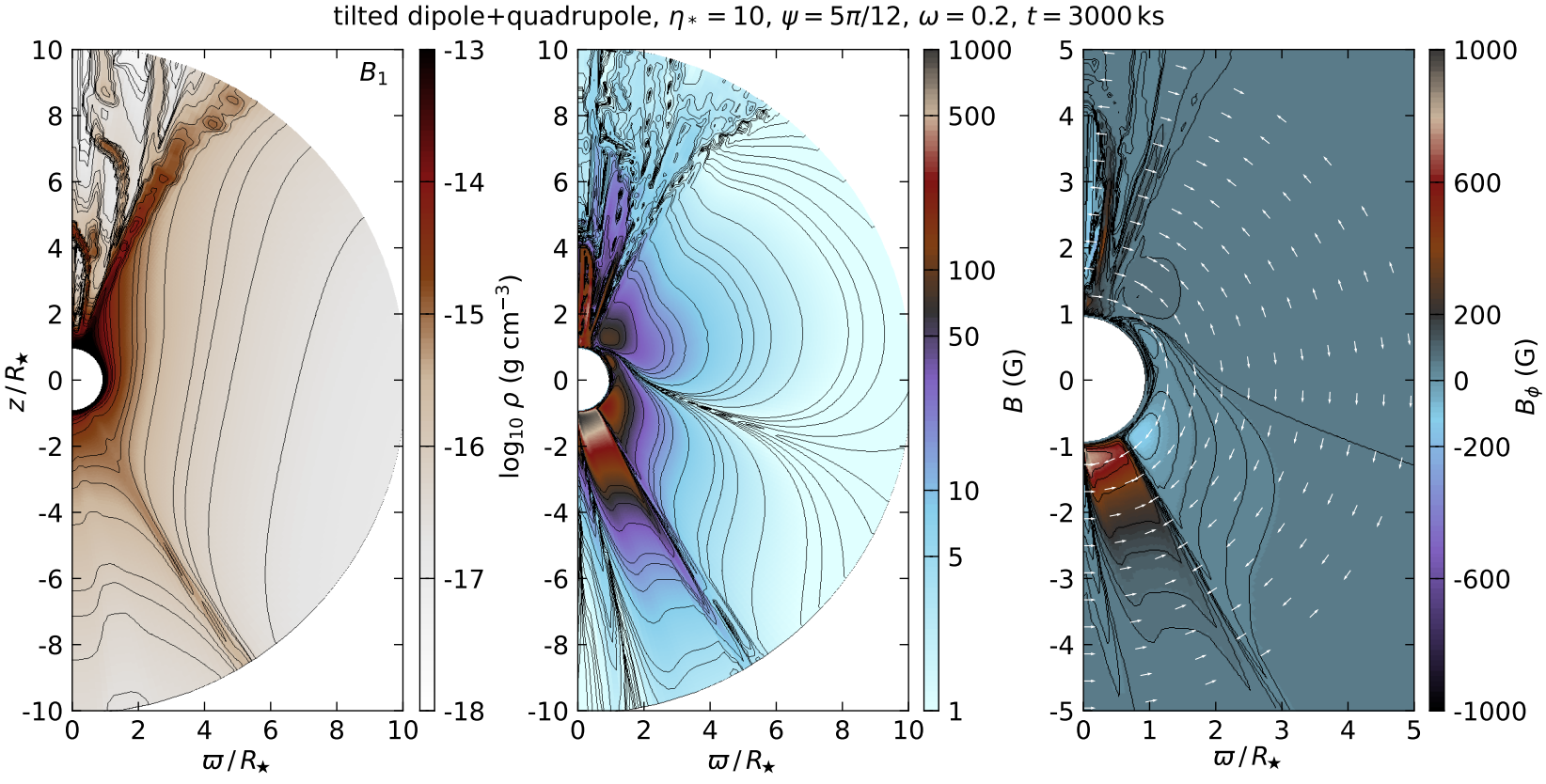


"Market" of potential topics for students' theses

Diploma and/or PhD thesis

Magnetohydrodynamic (MHD) models of corotating magnetospheres of hot stars

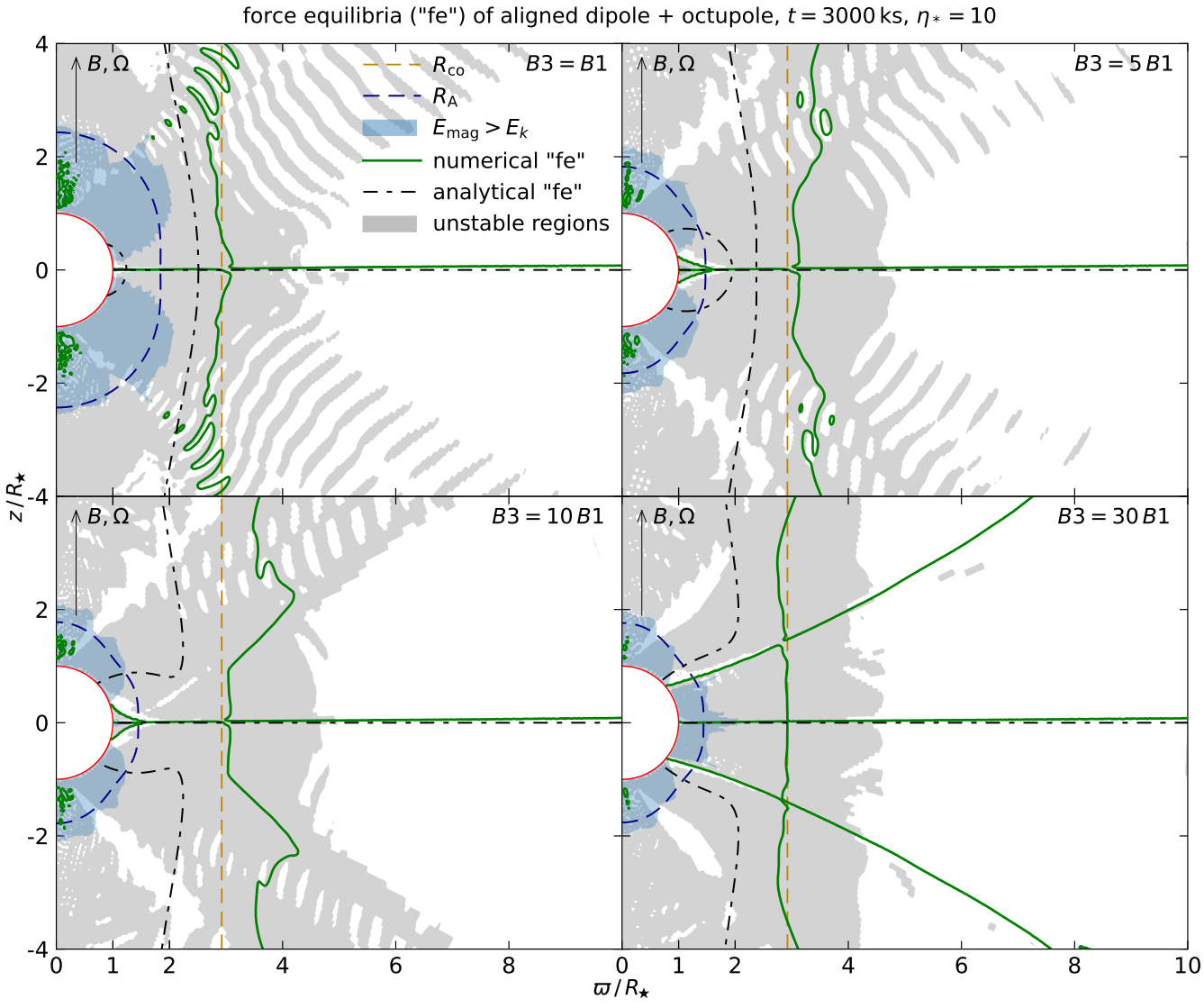
- MHD simulations of magnetically confined stellar winds or other forms of circumstellar medium (disks)



- Using the own Eulerian MHD code (Kurfürst+, in prep.) or other widely used MHD codes (Flash, Athena+, etc.)

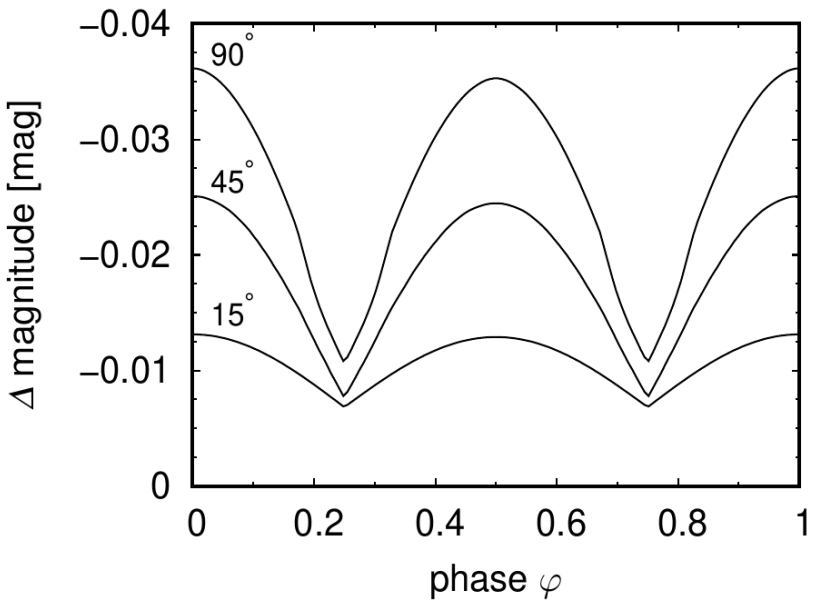
MHD models of corotating magnetospheres of hot stars

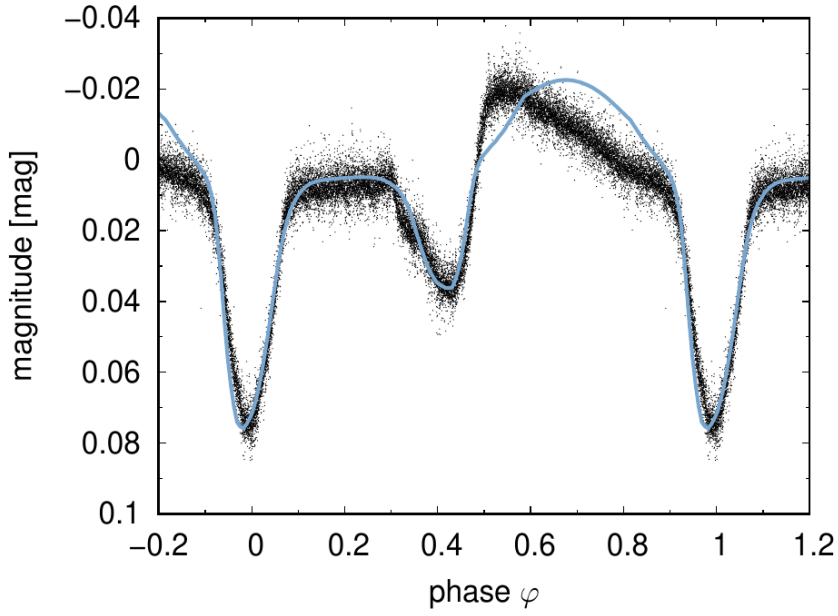
- Detailed calculations of physical and geometrical properties of circumstellar environment (Kurfürst+, in prep.):



Comparison of light curves

- Different phases correspond to different line-of-sight density and/or velocity distributions during the rotational period (Krtička+ 2022):





- Calculation of light curves using radiation transfer or Monte Carlo computational codes (RADMC-3D, Cloudy, etc.)