Combining SPH and MCRT for the study of ionising stellar feedback

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Types of radiation-hydrodynamics:

- **Difusion**
  
e.g. Lucy 1977, Brookshaw 1994

- **Flux-limited diffusion (FLD)**
  
e.g. Levermore & Pomraning 1981, Kolb et al. 2013

- **FLD + ray tracing**
  
e.g. Kuiper et al. 2010

- **Monte Carlo Radiative Transfer**

  - **MCRT + grid**
    
    Harries 2015

  - **MCRT + moving mesh**
    
    Vandenbroucke & Wood 2018

  - **MCRT + SPH**

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  - **MCRT + SPH**
Live Radiation-Hydrodynamics

Maya Petkova — Heidelberg

SPH

Grid construction

Assigning densities to grid cells

MCRT

Assigning ionic fractions to particles
Grid construction

Assigning densities to grid cells

Assigning ionic fractions to particles

SPH

MCRT
Voronoi grid construction
Voronoi grid construction

After 5 Lloyd’s iterations

Lloyd 1982
Grid construction
Assigning densities to grid cells
Assigning ionic fractions to particles
SPH
MCRT
SPH

Grid construction

Assigning densities to grid cells

Assigning ionic fractions to particles

MCRT
Density mapping on the grid

Petkova at al. 2018
Live Radiation-Hydrodynamics

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SPH

- Grid construction
- Assigning densities to grid cells
- Assigning ionic fractions to particles

MCRT
Grid construction

Assigning densities to grid cells

Assigning ionic fractions to particles

Price at al. 2018

Vandenbroucke & Wood 2018
D-type expansion of an H II region
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![Graph showing the expansion of an H II region with various solutions including Spitzer, Hosokawa-Inutsuka, StarBench, and Phantom + CMaclonize.](image)

- Spitzer solution (Spitzer 1978)
- Hosokawa-Inutsuka solution (Hosokawa & Inutsuka 2006)
- StarBench
- Phantom + CMaclonize (Bisbas et al. 2015)

Petkova at al. (in prep)
D-type expansion of an H II region

Petkova at al. (in prep)
Star Formation Simulation

- Total mass of $10^4 \, M_\odot$
- $10^6$ SPH particles
- Ionisation from stars with $M > 20 \, M_\odot$

Dale at al. 2012
Star Formation Simulation
Summary

Grid construction

Assigning densities to grid cells

Assigning ionic fractions to particles