

## DISCRETIZATION METHODS FOR RADIATION DIFFUSION PROBLEMS AND RELATED APPLICATIONS

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**Key Words:** *Radiation Diffusion, Discretization Method, Application.*

### PROPOSAL

**Scope of the mini-symposium:** The numerical solution of radiation diffusion equations is an important issue in solving radiation hydrodynamics problems. Usually the energy transfer in radiation hydrodynamics is modelled as heat conduction equation (with single temperature), non-equilibrium diffusion equation (two-temperature or three-temperature equations), or multi-group diffusion equations, when different approximations are used for the description of physical problems. Generally radiation diffusion problems are multi-material, nonlinear, inhomogeneous, and strongly coupled. In practical computations, diffusion equations are often solved on distorted meshes (including mixed meshes and non-matched meshes), and computational cost is enormous. Owing to its adaptability to structured and unstructured meshes and capability to keep local conservation, finite volume method becomes a common discretization method for solving radiation diffusion problems. The topics in this mini-symposium include but are not limited to:

- Finite volume discrete schemes for radiation diffusion problems;
- Parallel computational methods;
- Iterative solution methods;
- Numerical analysis on stability, convergence property, and so on;
- Numerical simulations to application problems.

**Importance and applications:** Radiation hydrodynamics has wide applications in many fields such as inertial confinement fusion, magnetic confinement fusion, geology and astrophysics. Radiation diffusion causes the redistribution of energy, and its computational cost takes absolutely a large proportion in solving radiation hydrodynamic problems. So its results directly affect the efficiency and reliability of the whole simulation of the radiation hydrodynamics problems. It is a great challenge to construct numerical methods based on physical features, and numerical methods play key roles to realize numerical simulation to radiation hydrodynamic problems efficiently and accurately. The research aim is to devise robust discrete schemes preserving monotonicity and conservation, and to design parallel and iterative solution methods with high performance.

### REFERENCES

- [1] John I. Castor, *Radiation Hydrodynamics*, Cambridge University Press, 2007.
- [2] G.-W. Yuan, X.-D. Hang, Z.-Q. Sheng and J.-Y. Yue, Progress in numerical methods for radiation diffusion equations, *Chinese Journal of Computational Physics*, 26, 475-500, 2009.