STRUCTURE-PRESERVING METHODS FOR THE RADIATIVE TRANSFER EQUATION

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ABSTRACT

s In this talk, we discuss structure-preserving discretizations for the time-dependent radiative transfer equation with varying refractive index, describing the specific intensity of unpolarized light (cf. [1]).

We base our discussion on the metriplectic formalism derived in [2], which ensures that the fundamental laws of thermodynamics are satisfied, i.e., there is conservation of energy and dissipation of entropy. The metriplectic formalism describes the time-evolution of functionals of the specific intensity in terms of a Poisson bracket and a metric bracket. By proper discretization of the functionals and the brackets, the corresponding laws of thermodynamics also hold on a discrete level.

We present a discretization of the radiative transfer equation based on this metriplectic formalism and discuss the extension of the metriplectic formulation and discretization to the case of a bounded spatial domain with prescribed inflow boundary conditions.

References

[1] S. Chandrasekhar, *Radiative Transfer*, Dover publications (1960).

[2] M. Schlottbom, *Towards a metriplectic structure for radiative transfer equations*, Oberwolfach Rep. 18 (2021), 24–26.

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