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AN ANISOTROPIC DIFFUSION APPROXIMATION TO THERMAL RADIATIVE TRANSFER

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ABSTRACT

This paper describes an anisotropic diffusion (AD) method that uses transport-calculated AD coefficients to efficiently and accurately solve the thermal radiative transfer equations. By assuming weak gradients and angular moments in the radiation intensity, we derive an expression for the radiation energy density that depends on a non-local function of the opacity. This nonlocal function is the solution of a transport equation that can be solved with a single steady-state transport sweep once per time step, and the function's second angular moment is the anisotropic diffusion tensor. To demonstrate the AD method's efficacy, we model radiation flow down a channel in "flatland" geometry.

Key Words: Anisotropic diffusion, Thermal radiative transfer, Flux-limited diffusion, Hybrid methods, Flatland geometry