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On the modified random walk algorithm for Monte-Carlo radiation transfer *(Corrigendum)*

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In Sect. 2.3, the diffusion coefficient for the modified random walk is given in Eq. (18) as

$$D = \frac{1}{3\rho}\frac{\displaystyle\int_0^\infty \frac{B_\nu(T)}{\chi_\nu}\,\mathrm{d}\nu}{\displaystyle\int_0^\infty B_\nu(T)\,\mathrm{d}\nu}\cdot \tag{1}$$

This equation is correct, but the ratio of the integrals was referred to as "the inverse of the Rosseland mean mass extinction coefficient". This is incorrect, because the Rosseland mean opacity includes $\mathrm{d}B_\nu(T)/\mathrm{d}T$ terms rather than $B_\nu(T)$. Instead, the ratio of the integrals is the inverse of the Planck reciprocal mean mass extinction coefficient (in line with the terminology used by Fleck & Canfield 1984). We can write this mean mass extinction coefficient as:

$$\bar{\chi}_{P^{-1}} \equiv \frac{\displaystyle\int_0^\infty B_\nu(T)\,\mathrm{d}\nu}{\displaystyle\int_0^\infty \frac{B_\nu(T)}{\chi_\nu}\,\mathrm{d}\nu} \tag{2}$$

and the diffusion coefficient for the modified random walk can then be written as:

$$D = \frac{1}{3\rho\bar{\chi}_{P^{-1}}}\cdot \tag{3}$$

The reason why one does not recover the Rosseland mean opacity in the case of photon diffusion in the modified random walk is that this random walk occurs in an isothermal medium, for which the derivation of the traditional diffusion coefficient breaks down (since it assumes that temperature gradients are present).

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References

Fleck, Jr., J. A., & Canfield, E. H. 1984, J. Comput. Phys., 54, 508