B. Appendix

B.1. Numerical algorithm

Here, we briefly describe the iterative scheme which we use for the solution of the radiative transfer equation. As everywhere in this paper, the indices "m", "b", and "s" refer to the quantities defined at the midplane, at the upper or lower boundary, and in the equivalent spherical envelope, correspondingly. For clarity, we omit here the indices i and k labeling different dust components, as well as any dependence on other quantities than frequency. We refer to the equations which are solved at the corresponding steps of the numerical procedure.

1. Initial distributions of all quantities.
2. Ray tracing for each frequency ν, Eqs. (2), (3).
   Input:
   (a) frequency-dependent mean intensities
   $(J_\nu)_{m,b,s}$,
   (b) dust temperatures
   T_m, T_b, T_s ,
   (c) absorption and scattering coefficients
   σ^a_ν, σ^s_ν .
   Output:
   (a) frequency-dependent moments
   $(J_\nu,\, H_\nu,\, K_\nu)_{m,b,s}$.
3. Frequency integration and averaging, Eqs. (6) - (8), (11).
   Input:
   (a) frequency-dependent moments
   $(J_\nu,\, H_\nu,\, K_\nu)_{m,b,s}$.
   Output:
   (a) frequency-integrated moments
   $(J,\, H,\, K)_{m,b,s}$,
   (b) Eddington factors
   $f_m = K_m/J_m$,
   $f_b = K_b/J_b$,
   $f_s = K_s/J_s$,
   (c) geometric factors
   $X_m = J_m/J_s$,
   $X_b = J_b/J_s$,
   (d) averaged absorption and extinction coefficients
   σ_{J_m} , σ_{J_b} , σ_{J_s} , σ_{H_s} .
4. Solution of the moment equations, Eqs. (9), (10).
   Input:
   (a) averaged extinction coefficients
   σ_{H_s} ,
   (b) Eddington factors
   $f_s = K_s/J_s$,
   (c) geometric factors
   $X_m = J_m/J_s$,
   $X_b = J_b/J_s$.
   Output:
   (a) equivalent sphere mean intensities
   $\tilde{J}_s$,
   (b) disk mean intensities
   $\tilde{J}_m = X_m\, \tilde{J}_s$,
   $\tilde{J}_b = X_b\, \tilde{J}_s$.
5. Calculation of dust temperatures, Eq. (13).
   Input:
   (a) moment equation mean intensities
   $\tilde{J}_m$, $\tilde{J}_b$, $\tilde{J}_s$,
   (b) averaged absorption coefficients
   σ_{J_m} , σ_{J_b} , σ_{J_s} .
   Output:
   (a) dust temperatures
   $T_m = \mathcal{F}^{-1}(\sigma_{J_m} \tilde{J}_m)$,
   $T_b = \mathcal{F}^{-1}(\sigma_{J_b} \tilde{J}_b)$,
   $T_s = \mathcal{F}^{-1}(\sigma_{J_s} \tilde{J}_s)$.
6. Convergence check (Sect. 2.6); if necessary, go to step 2.
7. Ray tracing for each ν and viewing angles θ_v, Eqs. (2), (3).
   Input:
   (a) frequency-dependent mean intensities
   $(J_\nu)_{m,b,s}$,
   (b) dust temperatures
   T_m, T_b, T_s ,
   (c) absorption and scattering coefficients
   σ^a_ν, σ^s_ν .
   Output:
   (a) emergent intensity distribution
   I^+_ν ,
   (b) spectral energy distribution
   $\nu\, F_\nu$.

In the scheme, we implicitly assume that the appropriate boundary conditions should be applied, if necessary. If we solve the radiative transfer equation together with a system of hydrodynamical equations, the step 4 includes a solution of all those equations. The function $\mathcal{F}$ appearing at the step 5 results from the assumption of radiative equilibrium (Sect. 2). At the step 7, the source function is calculated using the midplane temperatures everywhere in the disk, i.e. assuming that $T\,(r,\vartheta) = T_m\,(r)$. The scattering term of the source function is computed linearly interpolating the mean intensity between the midplane $J_{\nu,m}$ and the boundary $J_{\nu,b}$ values.

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