Interstellar Shocked Medium wind n_{b} Bubble Termination shock D_1 f_2 , D_2 f_3 , D_3

Morlino et al., MNRAS 504 (2021) 4 Time-stationary transport equation in spherical geometry:

$$\frac{\partial}{\partial r} \left[r^2 D(r, p) \frac{\partial f}{\partial r} \right] - r^2 u(r) \frac{\partial f}{\partial r} + \frac{d \left[r^2 u \right]}{dr} \frac{p}{3} \frac{\partial f}{\partial p} + r^2 Q(r, p) = 0$$

- Arbitrary diffusion coefficient D(r,p)
- Injection only at the termination shock

$$Q(r,p) \propto \delta(p-p_{\rm inj}) \, \delta(r-R_s)$$

• Wind velocity profile: $u(r) = \begin{cases} u_1 = v_w & \text{for } r < R_s, \\ \frac{u_1}{\sigma} \left(\frac{R_s}{r}\right)^2 & \text{for } R_s < r < R_b, \\ 0 & \text{for } r > R_b; \end{cases}$

Boundary conditions:

1. No net flux at the cluster center: $r^2[D\partial_r f - uf]_{r=R_o} = 0$

$$r^2[D\partial_r f - uf]_{r=R_c} = 0$$

2. Matching the Galactic distribution: $f(r \to \infty, p) = f_{gal}(p)$