Advection (Hyperbolic)
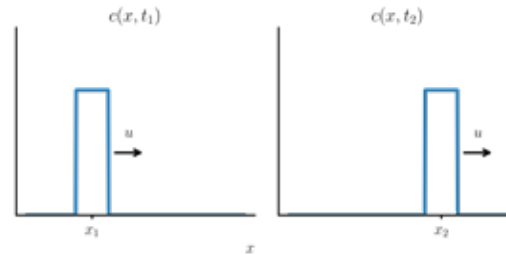
high Peclet number ($D \to 0$)

$$\frac{\partial c}{\partial t} + u\frac{\partial c}{\partial x} = 0$$

$c(x,t_1)$ $\qquad$ $c(x,t_2)$

$u \longrightarrow$ $\qquad$ $u \longrightarrow$

x_1 $\qquad$ x $\qquad$ x_2 $\qquad$ x

convection-
dominated
($\mathrm{Pe} \gg 1$)

Full Transport

$$\frac{\partial c}{\partial t} + u\frac{\partial c}{\partial x} = D\frac{\partial^2 c}{\partial x^2}$$
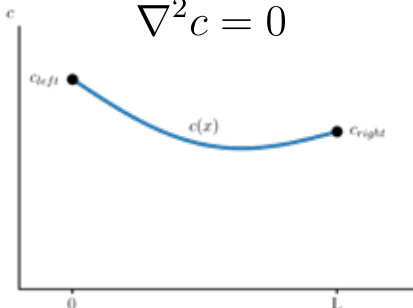
steady
state
($t \to \infty$)

diffusion-
dominated
($\mathrm{Pe} \ll 1$)

Equilibrium (Elliptic)

steady state ($\frac{\partial c}{\partial t} \to 0$)

$$\nabla^2 c = 0$$

c

c_{left}

$c(x)$

c_{right}

0 $\qquad$ L

Diffusion (Parabolic)

low Peclet number ($u \to 0$)

$$\frac{\partial c}{\partial t} = D\frac{\partial^2 c}{\partial x^2}$$

$c(x,t)$

$c(x,t_1)$

$t_2 > t_1$ $\qquad$ $c(x,t_2)$

x_0 $\qquad$ x