$$\frac{\partial u}{\partial t} = D_u \nabla^2 u + f(u,v)$$

$$\frac{\partial v}{\partial t} = D_v \nabla^2 v + g(u,v)$$

Solución espacialmente homogénea, estacionaria, u^*, v^*

$$\Rightarrow \quad 0 = f(u^*, v^*)$$

$$0 = g(u^*, v^*)$$

$$u = u^* + \delta u \quad ; \quad v = v^* + \delta v$$

$$\frac{\partial u}{\partial t} = \frac{\partial \delta u}{\partial t} \; ; \; \nabla^2 u = \nabla^2 \delta u \; ; \; \frac{\partial v}{\partial t} = \frac{\partial \delta v}{\partial t} \; ; \; \nabla^2 v = \nabla^2 \delta v$$

$$f(u,v) = f(u^* + \delta u, v^* + \delta v) \cong \underbrace{f(u^*, v^*)}_{=0}$$

$$+ \left.\frac{\partial f}{\partial u}\right|_{u^*, v^*} \delta u + \left.\frac{\partial f}{\partial v}\right|_{u^*, v^*} \delta v$$

$$\frac{\partial \delta u}{\partial t} = D_u \nabla^2 \delta u + \left.\frac{\partial f}{\partial u}\right|_{u^*, v^*} \delta u + \left.\frac{\partial f}{\partial v}\right|_{u^*, v^*} \delta v$$

$\nabla^2 = \frac{\partial^2}{\partial x^2}$ $\quad \delta u \sim \operatorname{sen}(kx)$

$$\Rightarrow \frac{\partial^2}{\partial x^2} \delta u = -k^2 \delta u$$

$\operatorname{sen}(\vec{k} \cdot \vec{r}) \longrightarrow -k^2 \delta u$

$$\frac{\partial}{\partial x^2} \longrightarrow -k^2$$

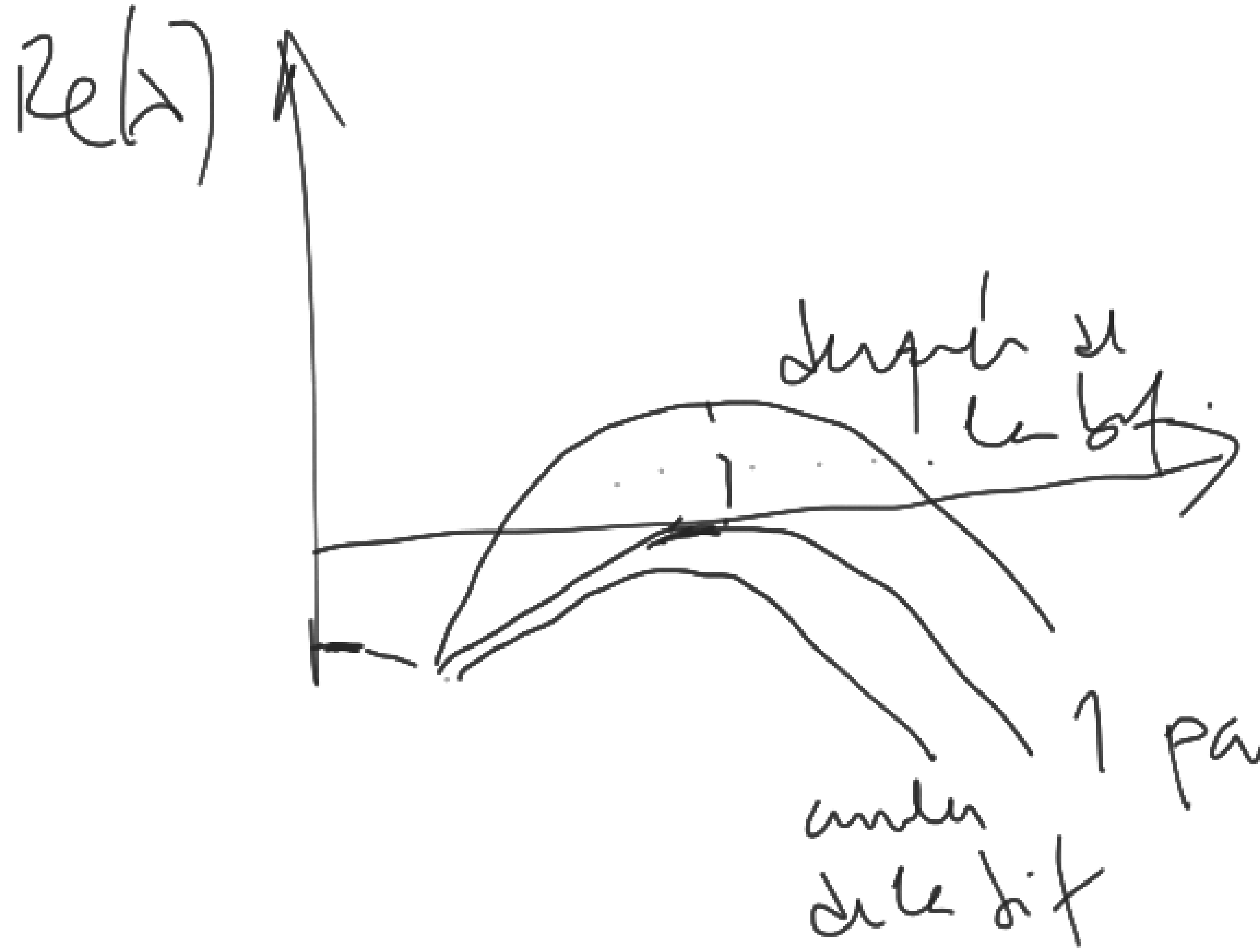
$$[k^2] = \frac{1}{[\text{long}]^2}$$

k = número de onda

$k \to 1$ modo

$$\frac{\partial}{\partial t}\delta u = -D_u k^2 \delta u + \frac{\partial f}{\partial u}\delta u + \frac{\partial f}{\partial v}\delta v$$

$$\delta u \propto \exp(\lambda t) \longrightarrow \lambda(k)$$



K

$$k = \frac{1}{\text{long}}$$

$k = 0$

$\Rightarrow$ long $\to \infty$

1 parámetro $\dfrac{D_v}{D_u}$

Inestabilidad con 1 long característica

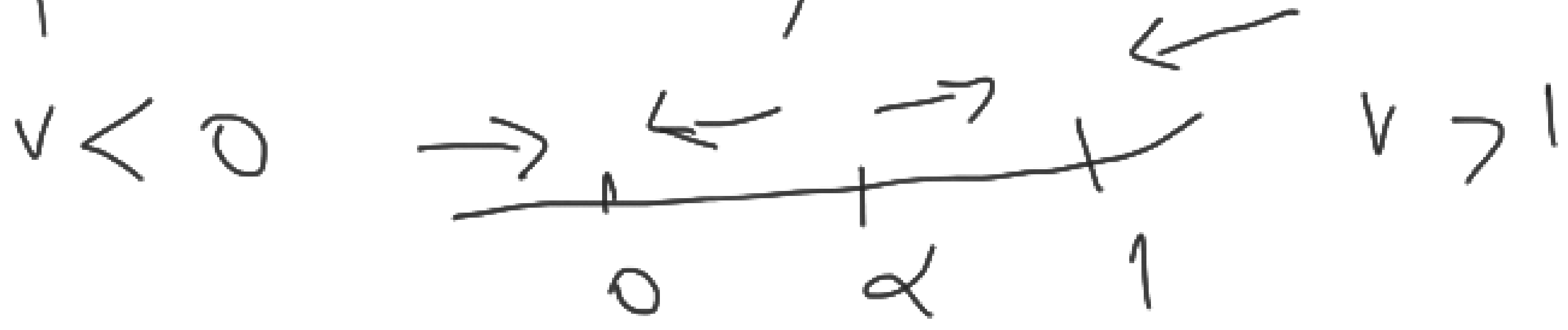
Propagación de frentes en sistemas biestables

FN $\quad \epsilon \dfrac{dv}{dt} = v(1-v)(v-\alpha) - w + I_{app}$

$$\frac{dw}{dt} = v - \gamma w \qquad\qquad 0<\alpha<1$$

Biestable $\quad \dfrac{dv}{dt} = v(1-v)(v-\alpha)$

3 puntos fijos $\quad v=0 \;;\; v=1 \;;\; v=\alpha$



$$\frac{\partial v}{\partial t} = \underbrace{\nabla^2 v}_{=\frac{\partial^2 v}{\partial x^2}} + A\, v(1-v)(v-\alpha)$$

$$\left.\frac{\partial^2 v}{\partial x^2}\right|_{x=x_n} = \frac{1}{\Delta x}\left(\left.\frac{\partial v}{\partial x}\right|_{\text{a la dr de } x_n} - \left.\frac{\partial v}{\partial x}\right|_{\text{a la izq de } x_n} \right)$$

$$= \frac{1}{\Delta x}\left[\left(\frac{v(x_{n+1}) - v(x_n)}{\Delta x} \right) - \left(\frac{v(x_n) - v(x_{n-1})}{\Delta x} \right) \right]$$

$$v_n = \frac{v_{n+1} + v_{n-1}}{2}$$

$$\frac{dv_n}{dt} = \frac{(\overbrace{v_{n+1}}^{=v(x_{n+1})} + v_{n-1} - 2v_n)}{(\Delta x)^2} + A v_n (1-v_n)(v_n - a)$$

Si yo estoy en 1 $v_n = 0$ y $v_{n+1} = v_{n-1} = 0$

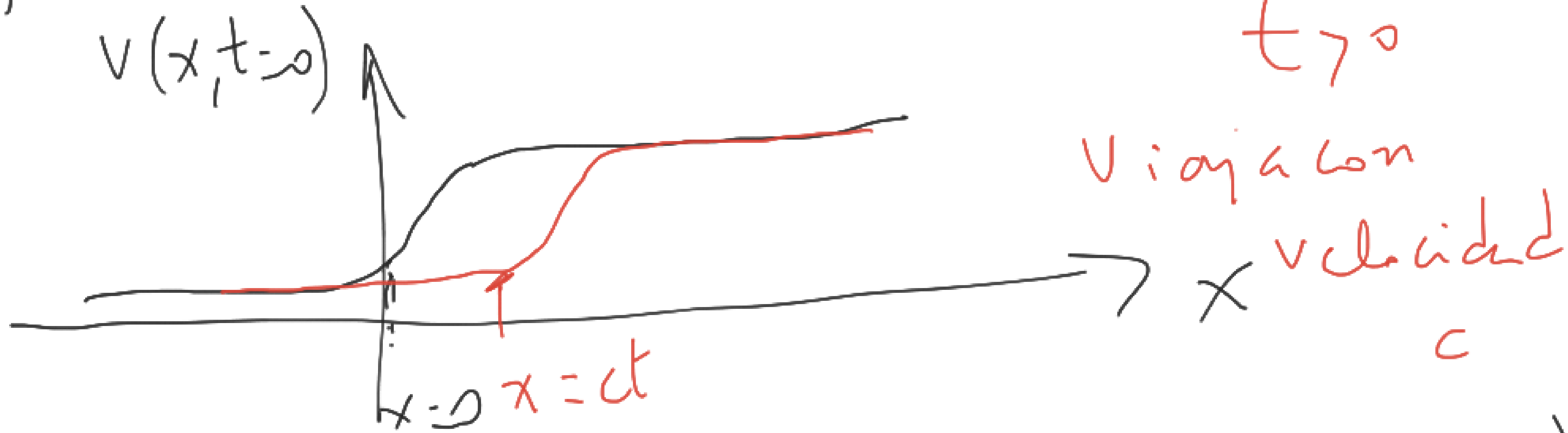
$$\Rightarrow \frac{dv_n}{dt} = 0$$

Si estoy en 1 $v_n = 1$ y $v_{n+1} = 1 = v_{n-1}$

$$\Rightarrow \frac{dv_{n+1}}{dt} = 0$$

$$\frac{\partial v}{\partial t} = \frac{\partial^2 v}{\partial x^2} + A v (1-v)(v-\alpha)$$

Esta ecuación admite soluciones viajeras $\longrightarrow$ $v(x,t) = f(\overbrace{x-ct}^{\xi})$



$$\frac{\partial v}{\partial t} = \frac{df}{d\xi}\frac{\partial \xi}{\partial t} = -c\frac{df}{d\xi} \; ; \; \frac{\partial v}{\partial x} = \frac{df}{d\xi}\frac{\partial \xi}{\partial x}$$

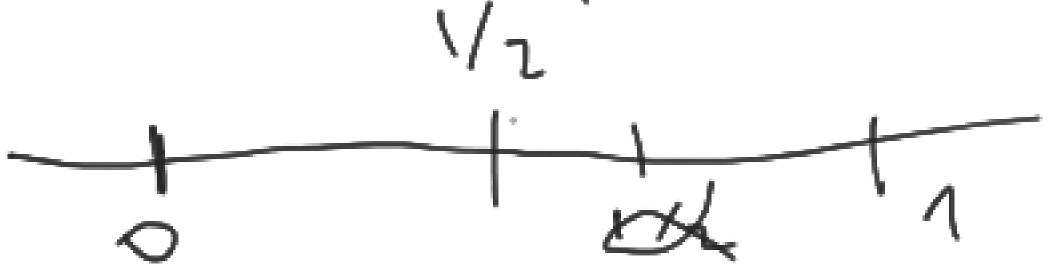
Tiene 1 solución que es:

$$v = \frac{1}{2} + \frac{1}{2}\tanh\left(\frac{\sqrt{A}}{2\sqrt{2}}(x - ct)\right)$$

$$c = \sqrt{\frac{A}{2}}\,(2\alpha - 1)$$

Si $2\alpha > 1 \iff \alpha > \frac{1}{2} \Rightarrow c > 0$

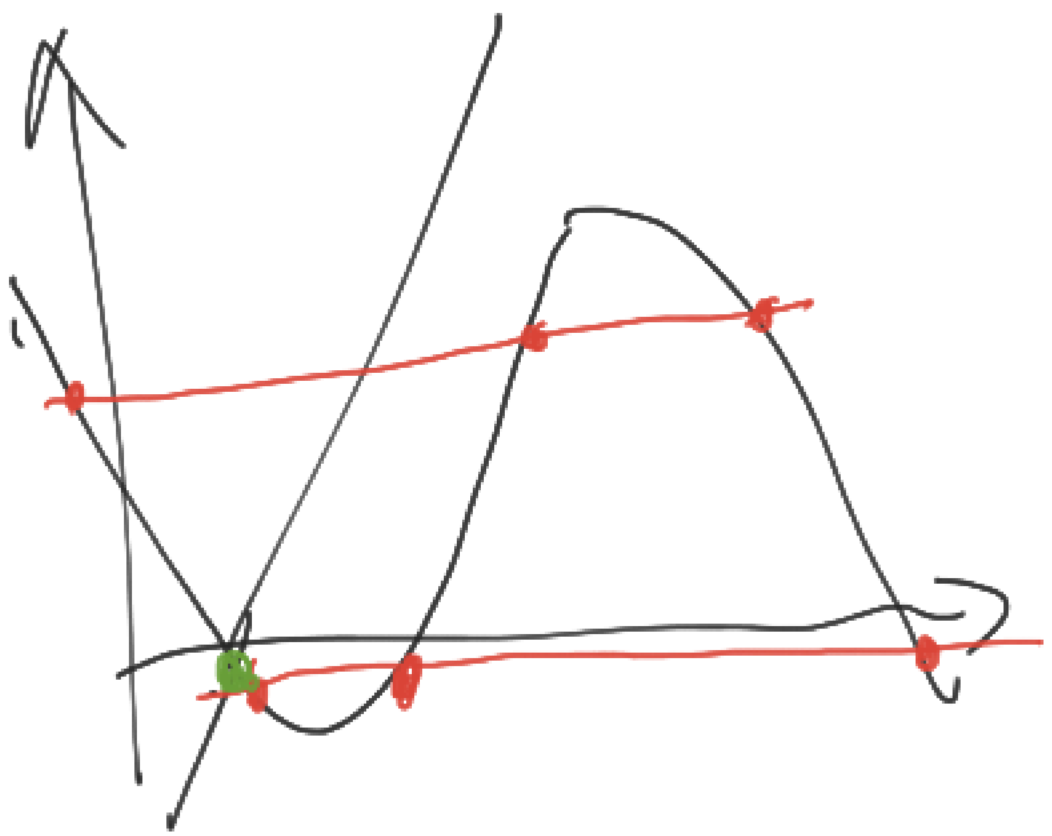
$\alpha < \frac{1}{2} \Rightarrow c < 0$

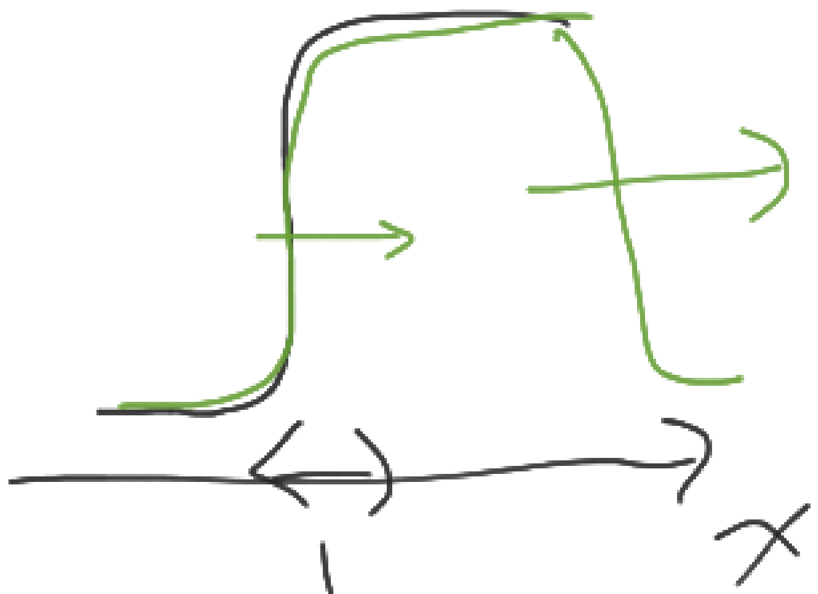


Analog. Excit.

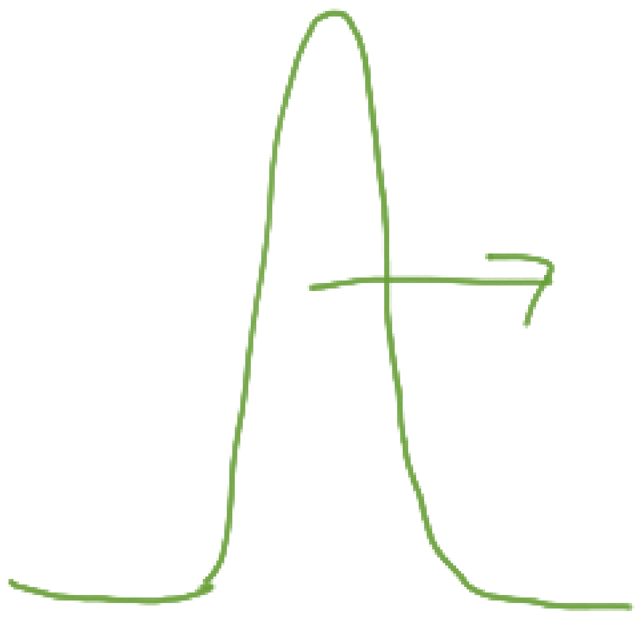
$$\epsilon \frac{\partial v}{\partial t} = \epsilon^2 \frac{\partial^2 v}{\partial x^2} + A\, v\,(1-v)(v-\alpha) - w$$

$$\frac{\partial w}{\partial t} = v - \gamma w$$





Frente importante $\epsilon \frac{\partial v}{\partial t} \sim \epsilon^2 \frac{\partial^2 v}{\partial x^2}$; $w \simeq$ cte



$$D = \frac{v_T^2 \tau}{2} = \frac{k_B T}{2m} \tau \qquad \frac{\tau}{2m} = \frac{D}{k_B T}$$

$$v_d = \frac{F}{m} \frac{\tau}{2} = \frac{F D}{k_B T}$$

$$n q v_d = j = \frac{q E D}{k_B T} n q = \underbrace{\frac{n q^2 D}{k_B T}}_{\sigma} E$$

$$j = \sigma E$$