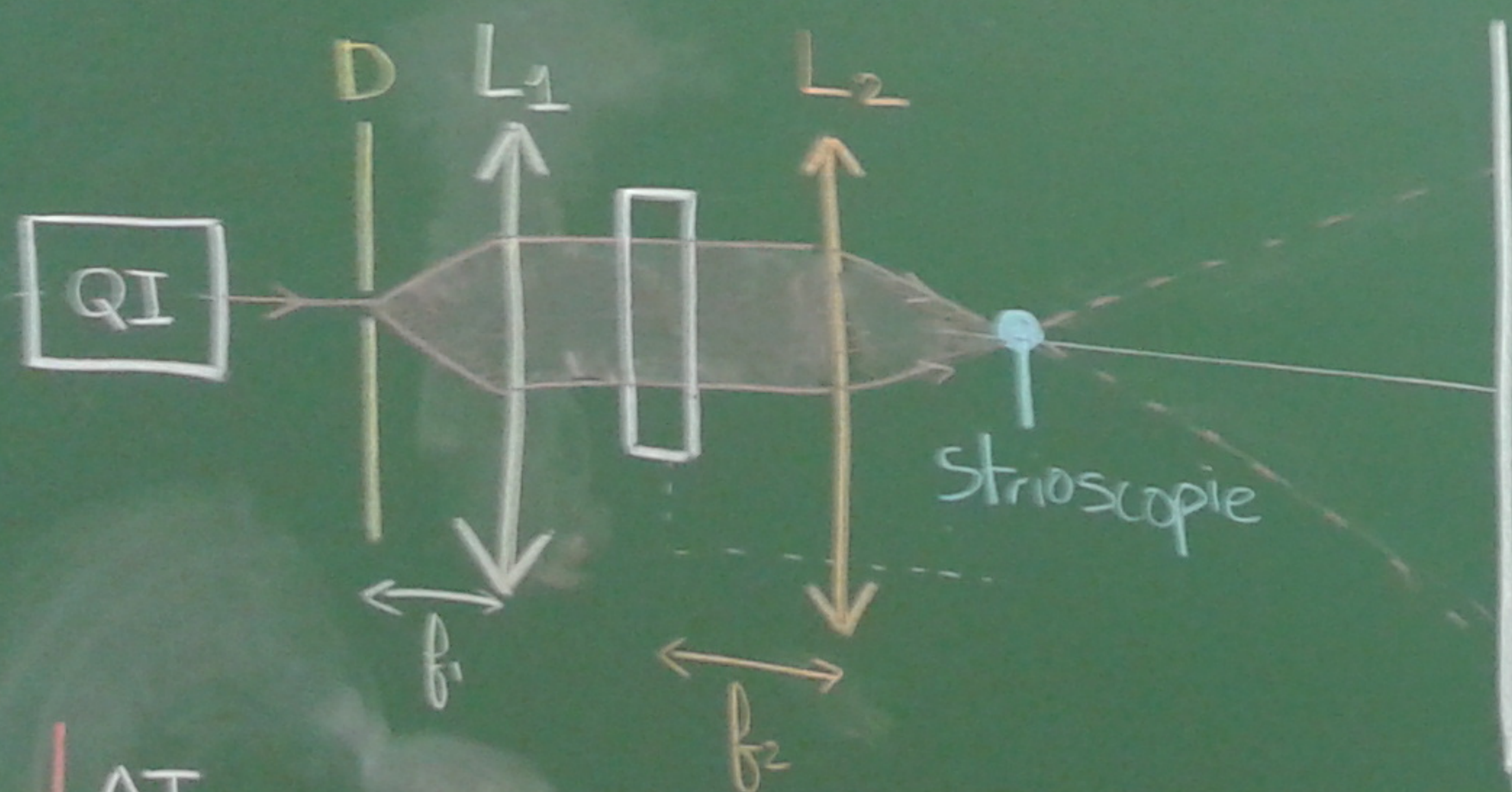


MP31

Instabilités et phénomènes non-linéaires

Linéaire — fonction de transfert
théorème de superposition
algèbre

I — Instabilité de Rayleigh-Bénard



$$\Delta T_c =$$

II — Pendule aux grands angles



$$\ddot{\theta} + \omega_0^2 \sin \theta = 0$$

• Linéarité du capteur

$$\begin{cases} U^{exp} = \\ \theta^{exp} = \end{cases}$$

$$\theta = aU + b$$

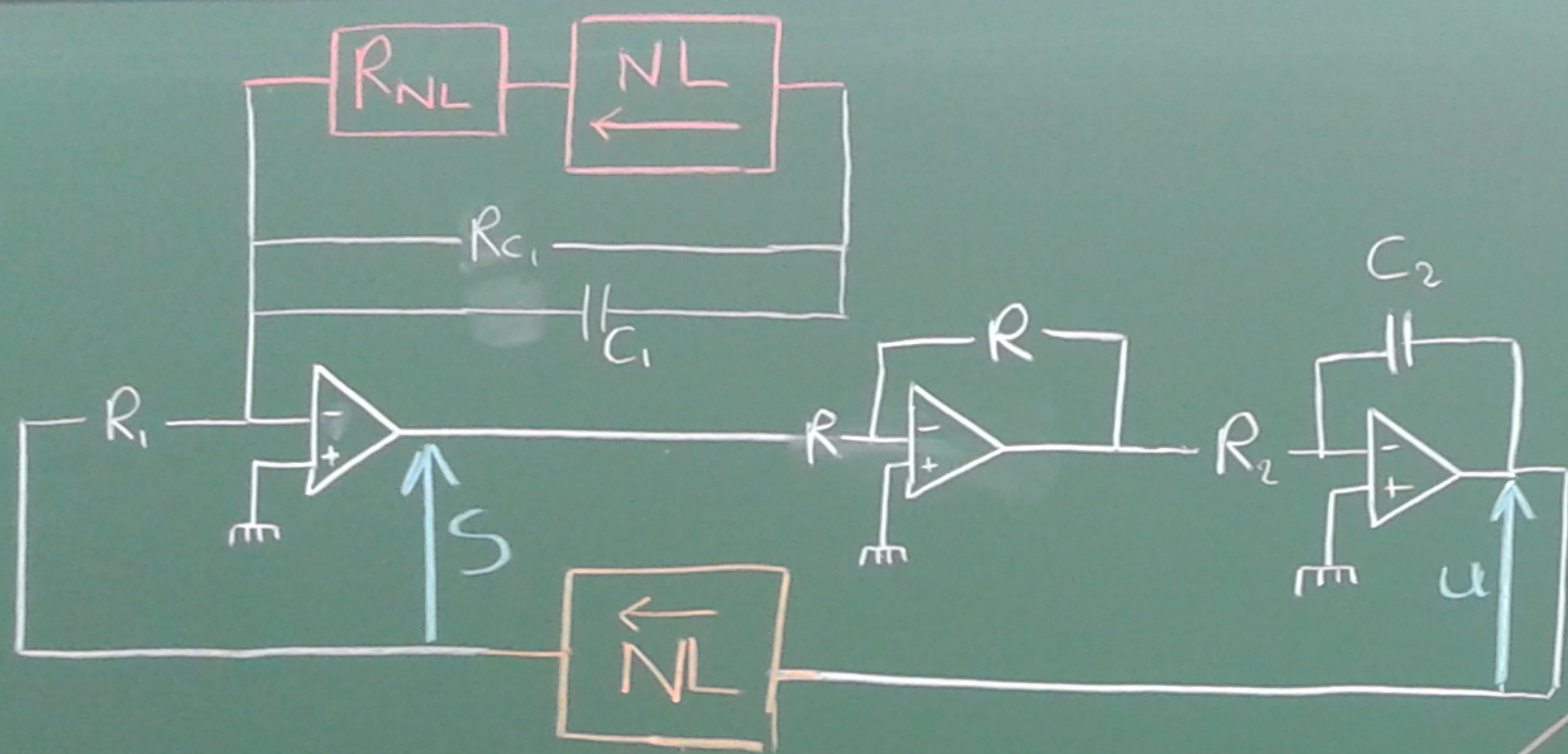
$$\begin{cases} a^{exp} = \\ b^{exp} = \\ \chi^2 = \end{cases}$$

• Formule de Borda

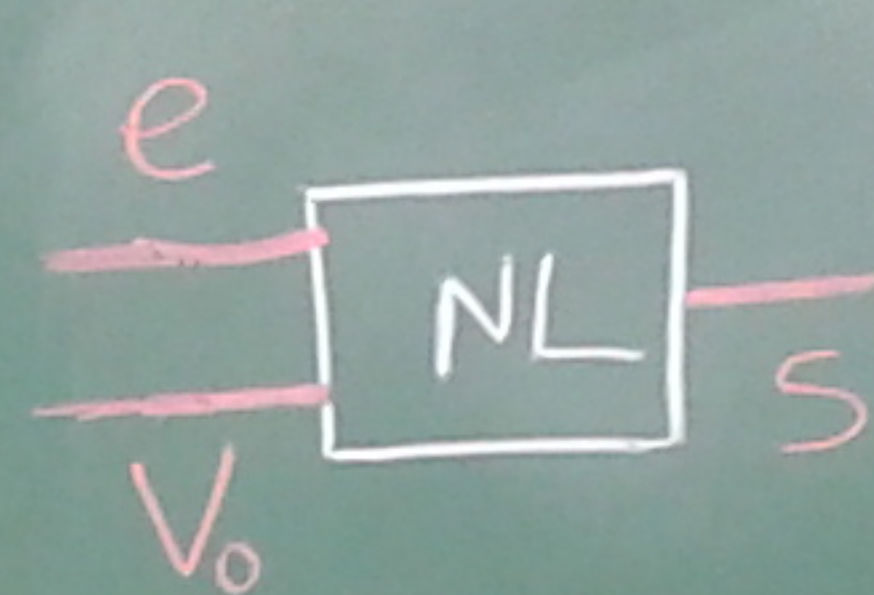
$$\begin{cases} t_1^{exp} = \\ t_2^{exp} = \\ \theta_{max}^{exp} = \end{cases}$$

$$T = T_0 (1 + c \theta_{max}^2)$$

$$\begin{cases} c^{th} = 0,625 \\ c^{exp} = \\ \chi^2 = \end{cases}$$



• Element non-linéaire



$$s = \alpha e + \beta e^3$$

$$\alpha = -KV_0$$

$$\left| \begin{array}{l} \alpha = \\ K = \end{array} \right.$$

III - Van der Pol

$$\ddot{s} - \epsilon \omega_0 \left(1 - \left(\frac{s}{s_0} \right)^2 \right) \dot{s} + \omega_0^2 s = 0$$

• Bifurcation de Hopf

$$\left| \begin{array}{l} R_{NL} = \\ s_{exp} = \end{array} \right.$$

$$\underline{s^2 = a(b - R_{NL})}$$

$$a^{th} = (4,08 \pm 0,02) 10^{-4}$$

$$b^{th} = (3,34 \pm 0,06) \cdot 10^4$$

$$a^{exp} =$$

$$b^{exp} =$$

$$\chi^2 =$$

IV - Double puits

$$\ddot{u} + a\dot{u} - bu + cu^3 = 0$$

• Présence de deux attracteurs

• Forçage, chaos