Short-distance propagation of nonlinear optical pulses

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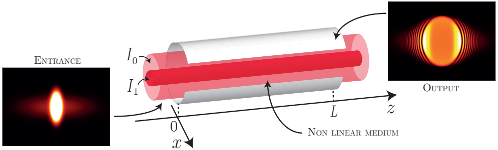
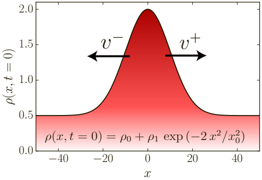
General context



Stationary propagation of the complex amplitude of the electric field :

$$\mathrm{i}\partial_z A = -\frac{1}{2\, n_0\, k_0} \vec{\nabla}_\perp^2 A + k_0\, n_2\, |A|^2\, A\,, \qquad (1)$$



- Fluid of light :

$\hookrightarrow \rho \propto I = |A|^2,\ t \propto z,\ \nabla_\perp \propto \frac{\partial}{\partial x},\ P = \rho^2/2.$

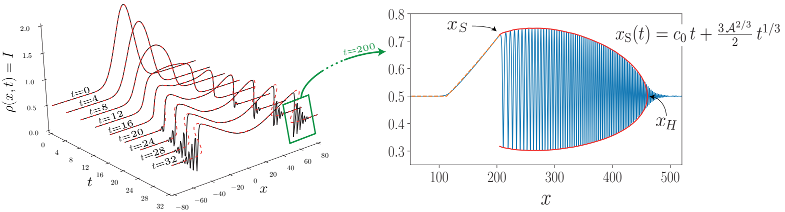
$$\begin{cases} \rho_t + (\rho u)_x = 0, \\ u_t + u u_x + \dfrac{1}{\rho} P_x = 0. \end{cases}$$

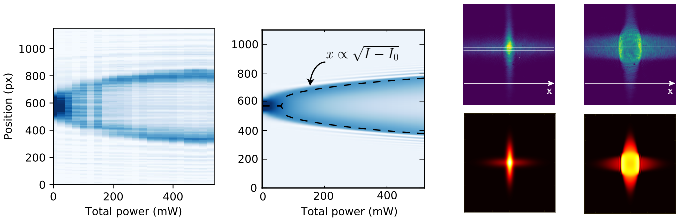
Results

$$\hookrightarrow \lambda^{\pm}(x,t) = \tfrac{1}{2}u(x,t) \pm \sqrt{\rho(x,t)},$$

$$\hookrightarrow (x,t) = \mathrm{fct}(\lambda^{-},\lambda^{+}).$$

$$\Rightarrow \frac{\partial x}{\partial \lambda^{\pm}} - \left(\frac{3}{2}\lambda_{\mp} + \frac{1}{2}\lambda_{\pm}\right)\frac{\partial t}{\partial \lambda^{\pm}} = 0$$





[MI, A. M. Kamchatnov, N. Pavloff, arXiv :1902.06975 (2019)]