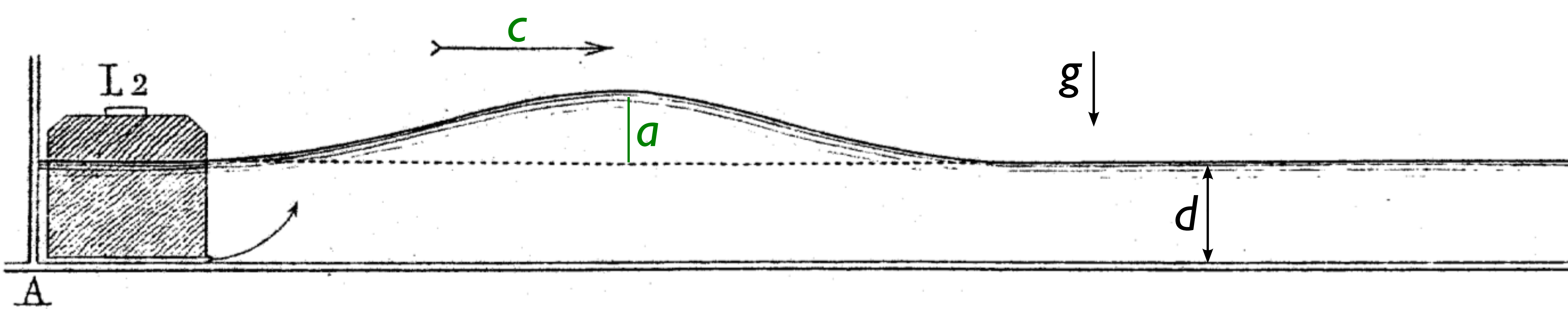
John Scott Russell

« a large solitary elevation […] which continued its course along the channel apparently **without change of form or diminution of speed**. […] Such, in the month of August 1834, was my first chance interview with that singular and beautiful phenomenon which I have called the Wave of Translation. »

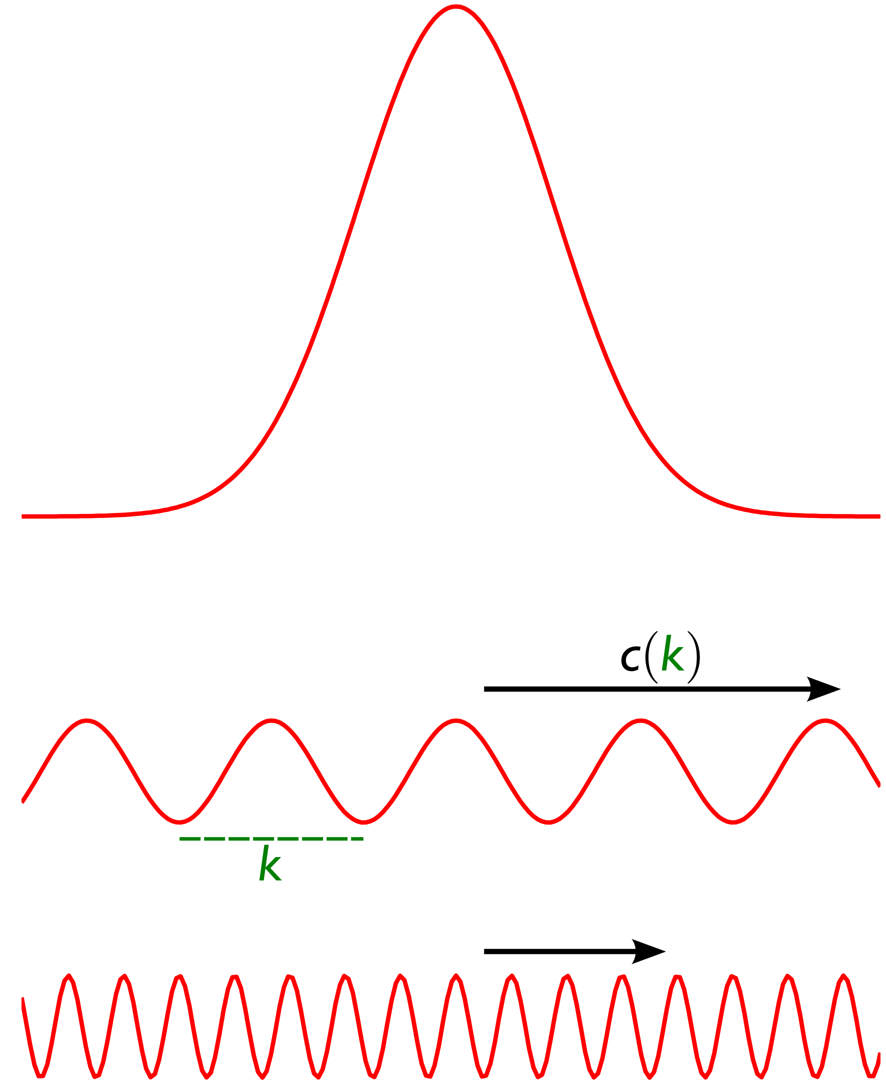
Report on waves (1845)



Linéaire, dispersif

$$\partial_t f + \partial_x\left(\sqrt{g\frac{\tanh(d|D|)}{|D|}}f\right) = 0$$

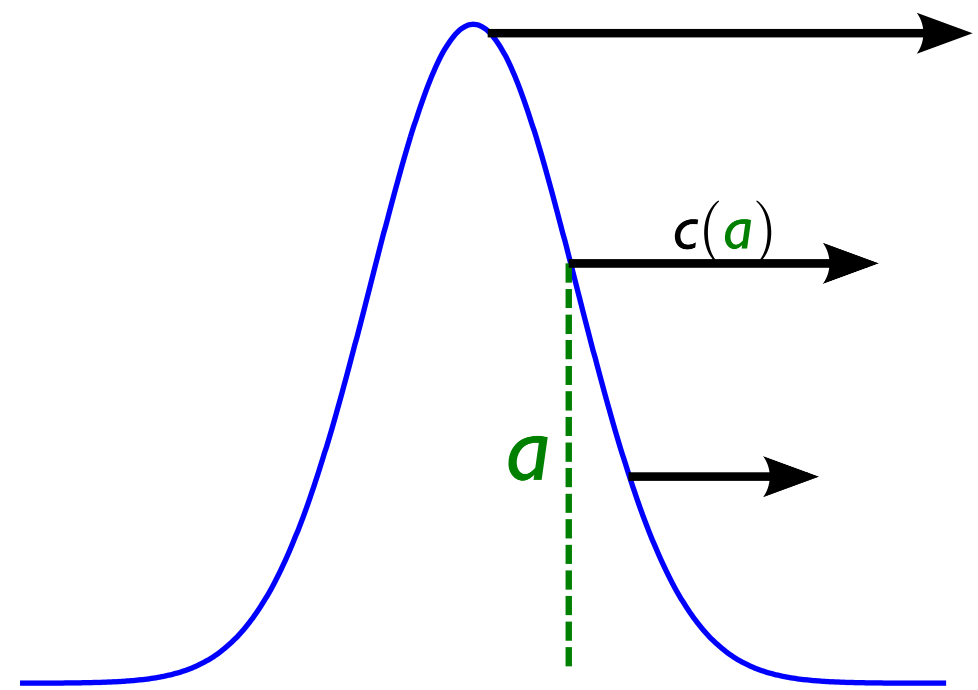
$$c(k) = \sqrt{g\frac{\tanh(d|k|)}{|k|}}$$



Non-linéaire, non-dispersif

$$\partial_t f + \partial_x\left(\sqrt{gd}\left(f + \tfrac{3}{4d}f^2\right)\right) = 0$$

$$c(a) = \sqrt{gd}\left(1 + \tfrac{3}{4d}a\right)$$



Linéaire, dispersif

$$\partial_t f + \partial_x\left(\sqrt{g\frac{\tanh(d|D|)}{|D|}}f\right) = 0$$

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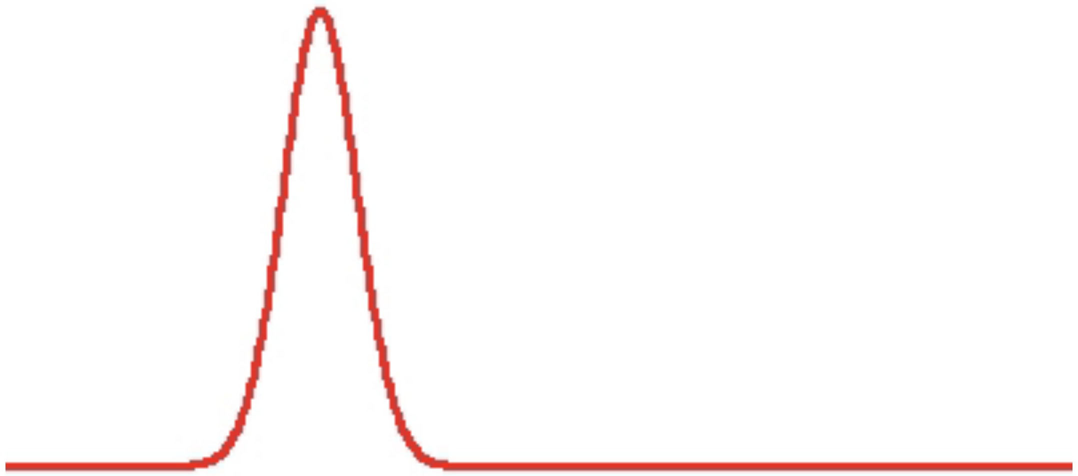
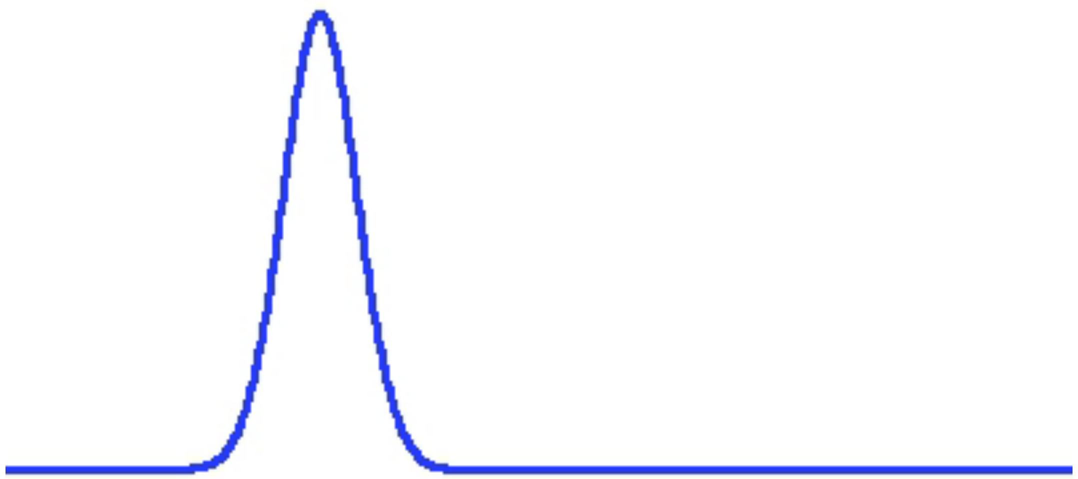


Non-linéaire, non-dispersif

$$\partial_t f + \partial_x\left(\sqrt{gd}(f + \tfrac{3}{4d}f^2)\right) = 0$$

$$c(a) = \sqrt{gd}(1 + \tfrac{3}{4d}a)$$



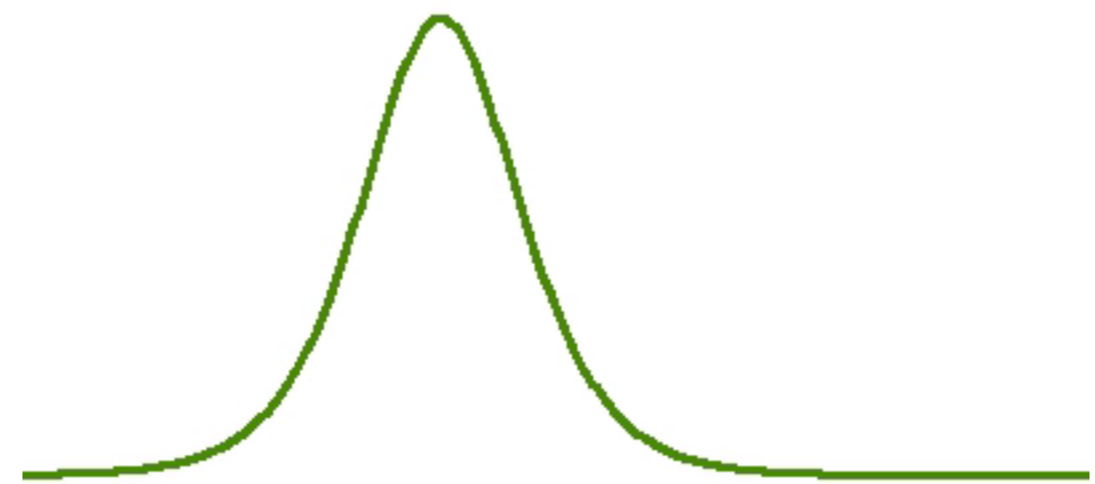
Boussinesq, Rayleigh, Korteweg, de Vries (1871–1895)

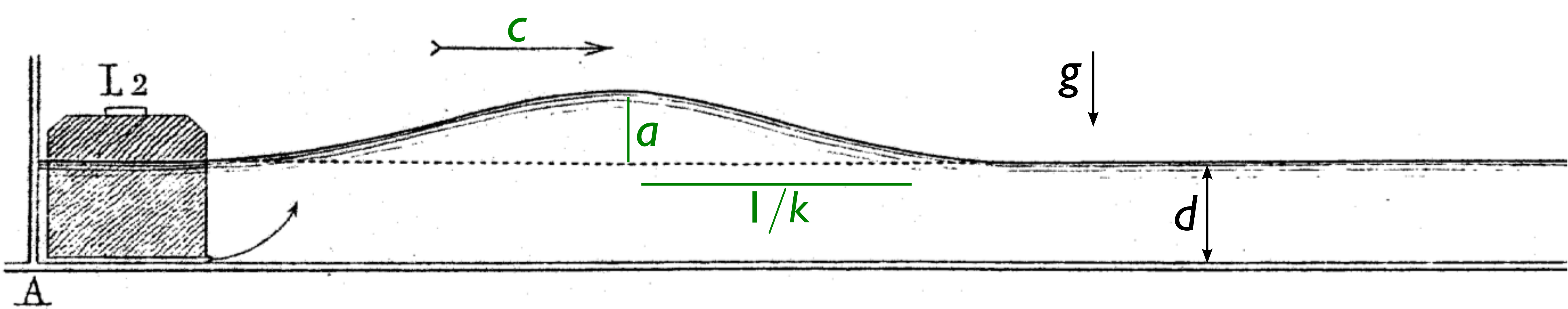
$$\partial_t f + \partial_x\left(\sqrt{gd}\left(f + \frac{3}{4d} f^2 + \frac{d^2}{6}\partial_x^2 f\right)\right) = 0 \qquad \text{(KdV)}$$

Ondes solitaires

$$f(t,x) = a\,\mathrm{sech}^2(k(x-ct))$$

$$k = \sqrt{\frac{3a}{4d^3}} \qquad c = \sqrt{gd}\left(1 + \frac{a}{2d}\right)$$

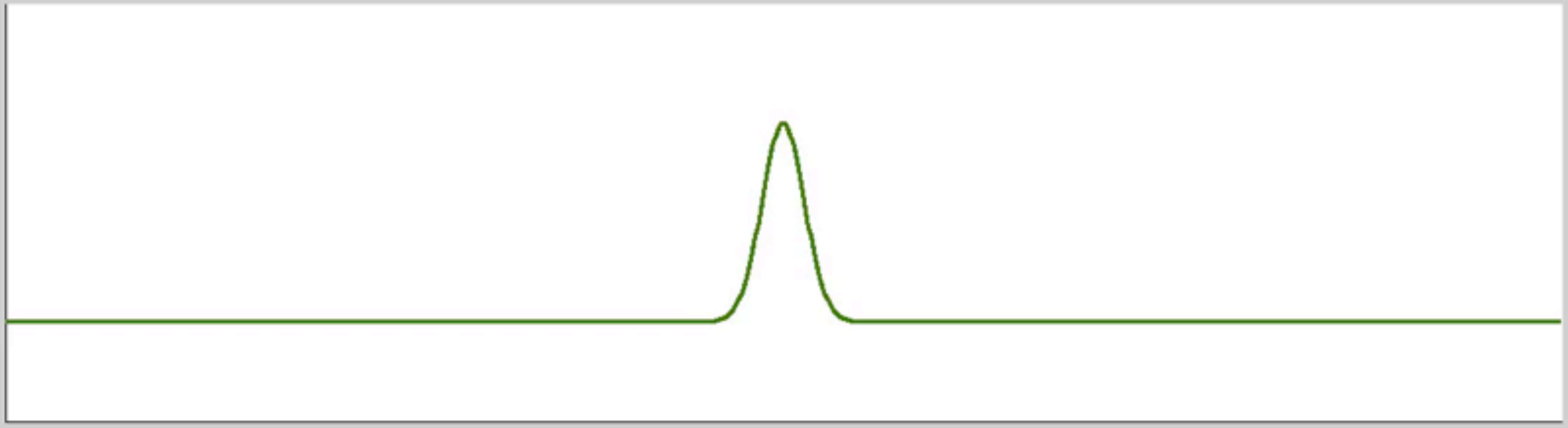




Zabusky, Kruskal, Miura, Gardner, Greene (1965—)

Collision de solitons

Résolution en solitons




Île de Ré
Auteur : Michel Griffon