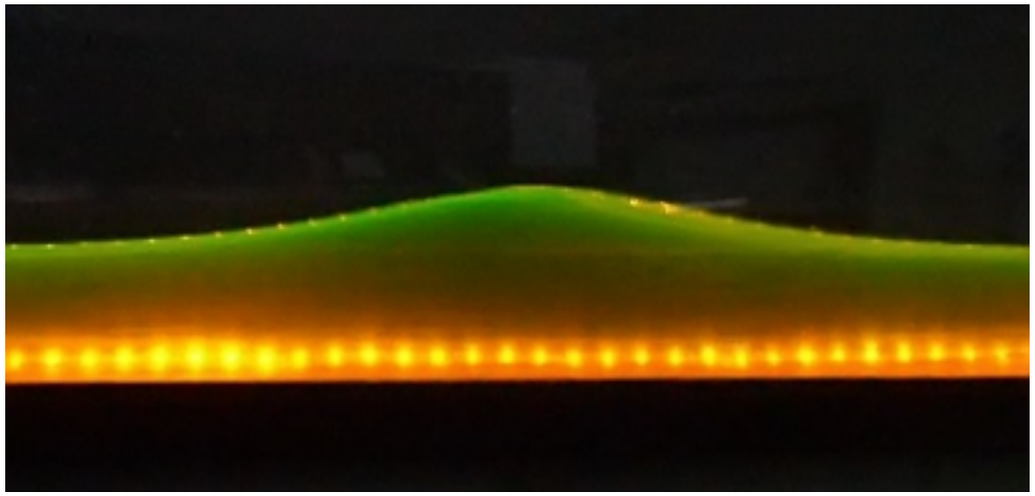
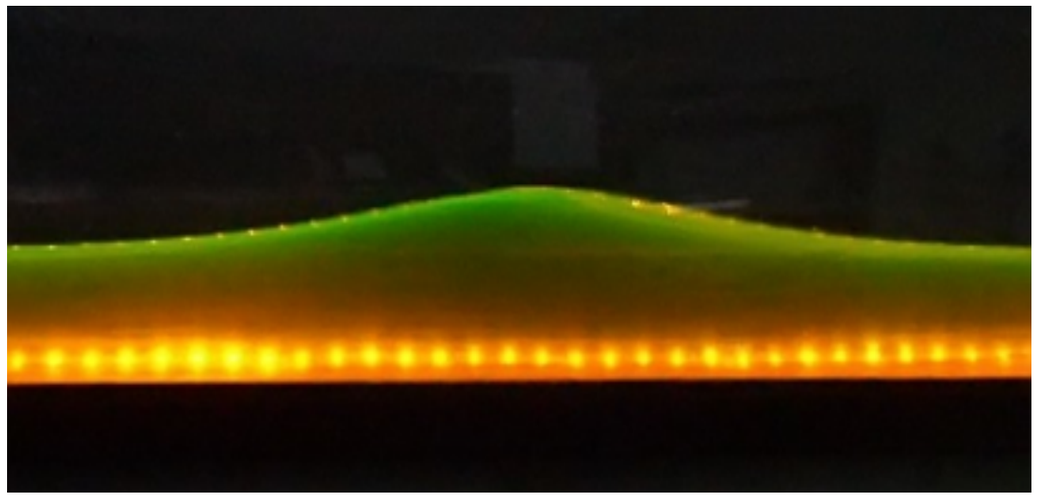
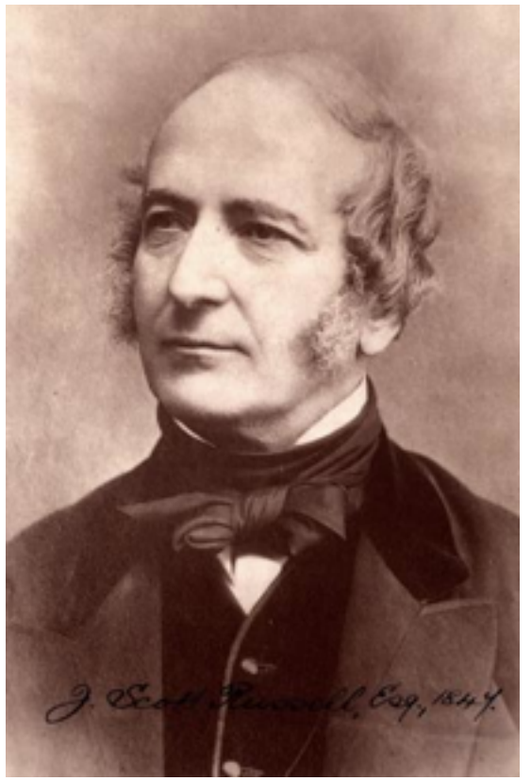
Solitons

18.354 L22



John Scott Russell





9 May 1808 – 8 June 1882

1834 Discovery of solitons

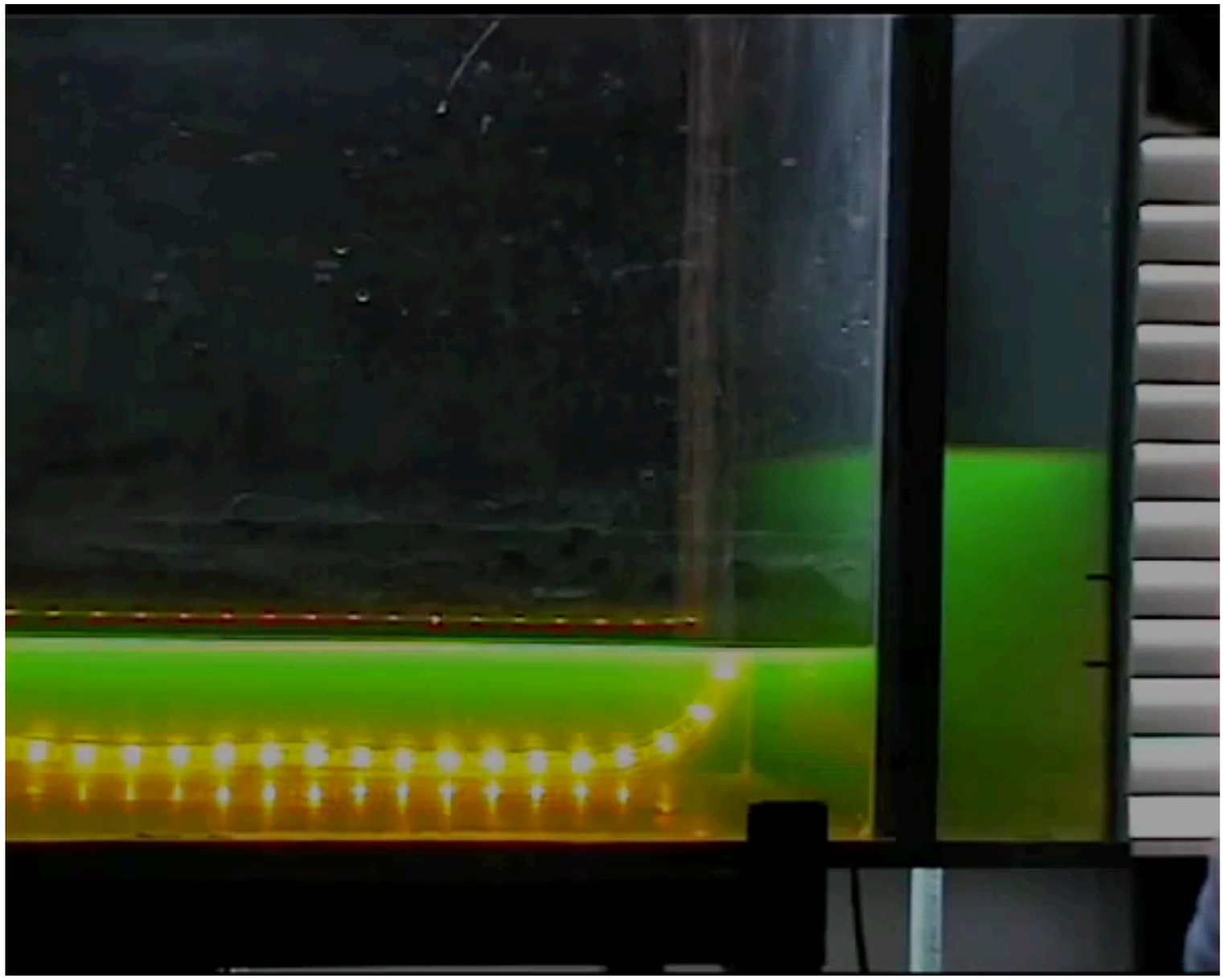
- The waves are stable, and can travel over very large distances (normal waves would tend to either flatten out, or steepen and topple over)
- The speed depends on the size of the wave, and its width on the depth of water.
- Unlike normal waves they will never merge—so a small wave is overtaken by a large one, rather than the two combining.
- If a wave is too big for the depth of water, it splits into two, one big and one small.

Russell's description

I was observing the motion of a boat which was rapidly drawn along a narrow channel by a pair of horses, when the boat suddenly stopped—not so the mass of water in the channel which it had put in motion; it accumulated round the prow of the vessel in a state of violent agitation, then suddenly leaving it behind, rolled forward with great velocity, assuming the form of a large solitary elevation, a rounded, smooth and well-defined heap of water, which continued its course along the channel apparently without change of form or diminution of speed. I followed it on horseback, and overtook it still rolling on at a rate of some eight or nine miles an hour [14 km/h], preserving its original figure some thirty feet [9 m] long and a foot to a foot and a half [300–450 mm] in height. Its height gradually diminished, and after a chase of one or two miles [2–3 km] I lost it in the windings of the channel. 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.

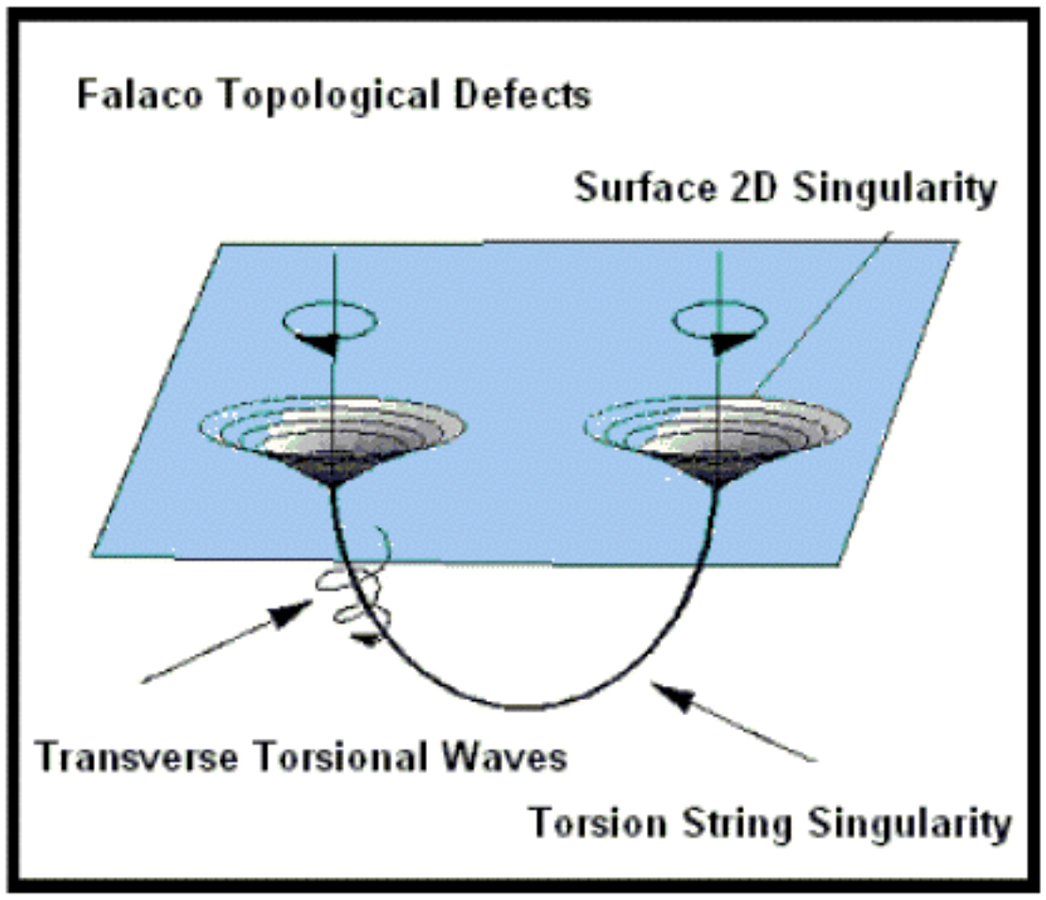
Time-line

- 1834: discovery by Russell
- disputed by Stokes and Airy
- 1871: Joseph Boussinesq
- 1876: supported by Rayleigh
- 1895: Korteweg and de Vries
- 1953: Fermi-Pasta-Ulam-Tsingou
- >1960: physics, electronics, biology, fibre optics
- 1965 Zabesky and Kruskal



credit: Christophe Finot

Falaco soliton



R M Kiehn

Falaco soliton