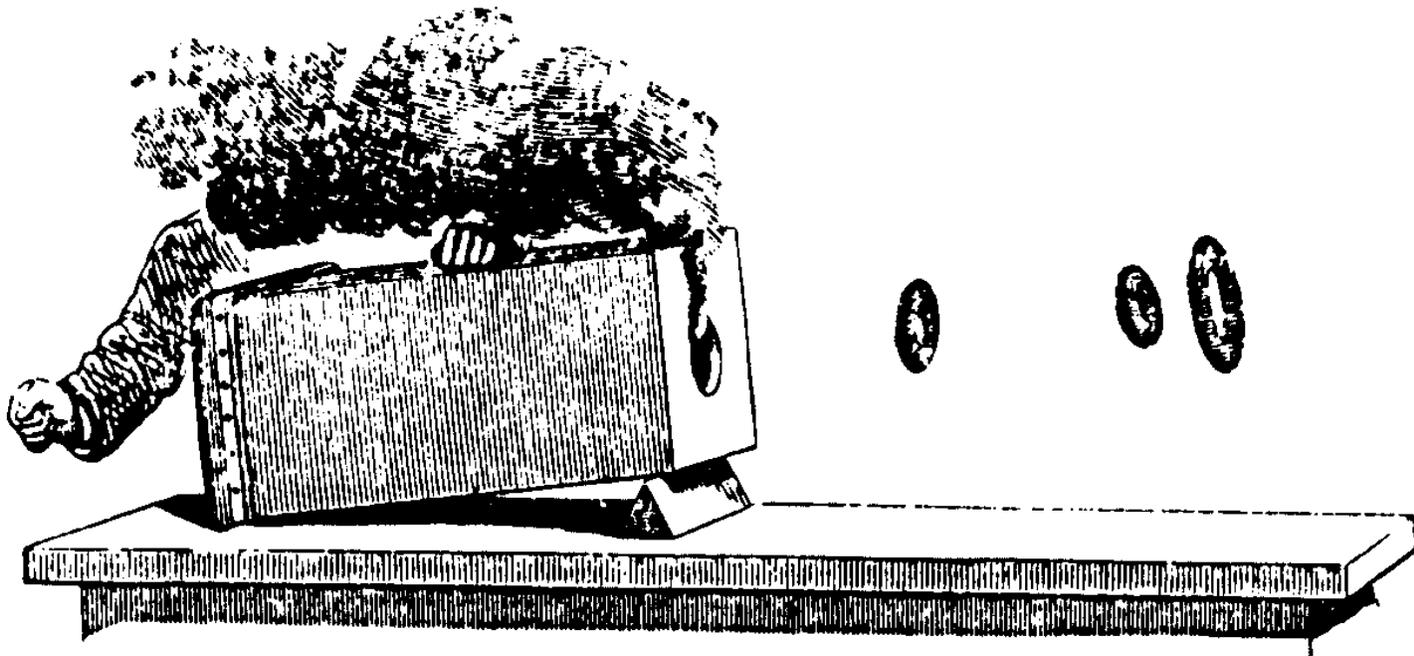


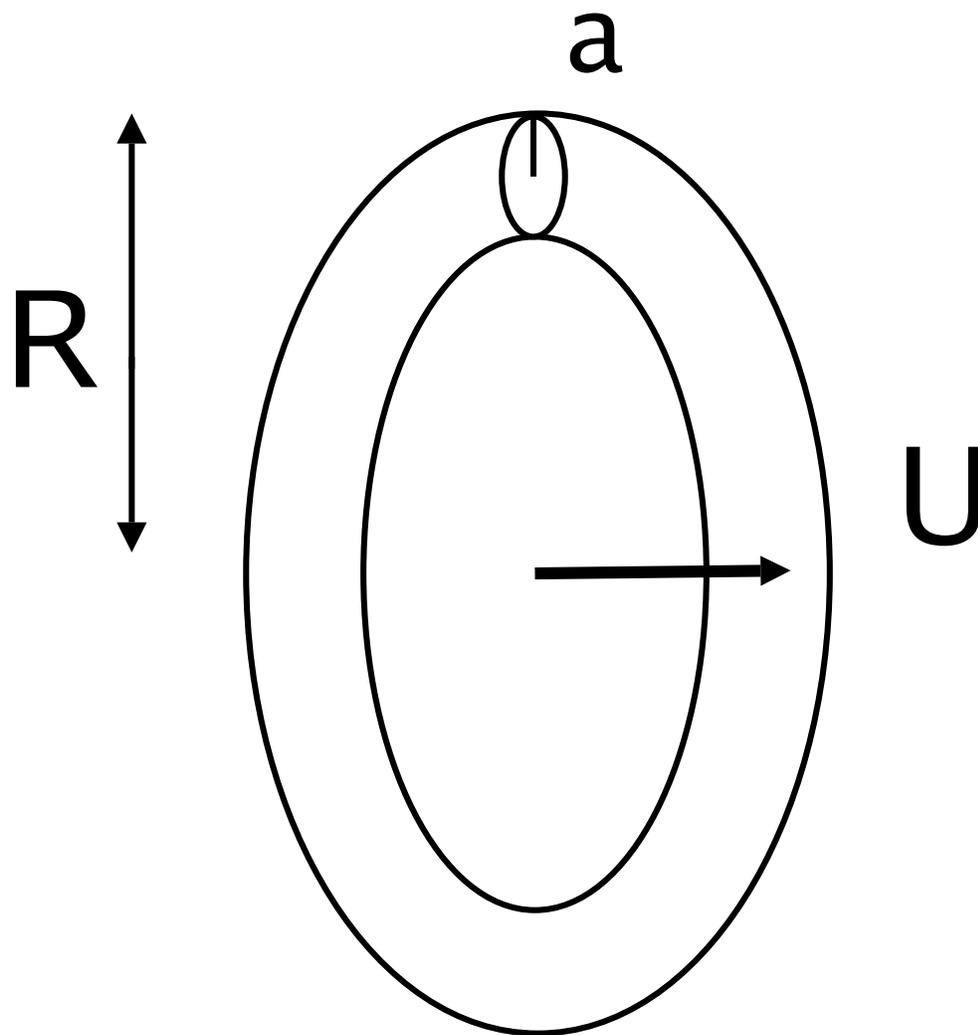
*William Mitchinson Hicks as a fluid dynamicist*



Tate (1876)

Hicks (1850-1934) was one of the first students of J.C. Maxwell, in the same generation as H. Lamb (1849-1934), another famous fluid dynamicist.

He specialised in vortex dynamics, which was initiated by H. Helmholtz about 150 years ago, and pioneered in the theory of vortex rings.



What did he do in research ?

He gave a complete derivation of the correct asymptotic formula for the propagating speed of a thin-cored vortex ring with uniform cross-sectional vorticity for the first time.

Historical background: Kelvin's prophecy (1867)  
When Tait's translation of the Helmholtz's paper appeared, Kelvin stated without proof that

$$U = \frac{\Gamma}{4\pi R} \left( \log \frac{8R}{a} - \frac{1}{4} \right),$$

where  $\Gamma$  denotes circulation. On the other hand, J.J.Thomson(1883) and C.T.Lewis(1879) had

$$U = \frac{\Gamma}{4\pi R} \left( \log \frac{8R}{a} - 1 \right),$$

which was not consistent with the above.

In 1885 he was able to show that Kelvin was right, together with further results for cases of non-uniform distribution of vorticity. (See Lamb(1932) or Saffman (1992) for details.)

XV. *Researches on the Theory of Vortex Rings.*—Part II.

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Received June 13,—Read June 18, 1885.

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THE present communication forms a continuation of some researches the first part of which was published in Part I. of the Transactions for 1884.\* In that paper was considered the case of a circular hollow with cyclic motion round it. In the following pages the more general case is investigated where the core is of different density from that of the surrounding fluid, has a hollow inside it, and circulations additional to that due to the rotational filaments actually present. The investigation

\* References to this are in square brackets, thus [I. 5]. [T. F.] refers to a paper on "Toroidal Functions" in Phil. Trans., Vol. 172 (1881), containing the theory of the functions used.

Its modern significance:

The 3D Euler equations may be regarded as an infinite dimensional Hamiltonian system. The error contained, e.g. in J.J. Thomson's *Treatise on the motion of vortex rings* (1883), spoiled the underlying Hamiltonian structure, as observed by P.H. Roberts (1972). In this sense, the mistake was more serious than it may seem.

Analyses are analyses; once they are done they will last forever, whatever the fate of the original motivation of *vortex atom*. Nowadays, a description of fluids based on vortex rings finds its applications in turbulence, quantum fluids, biological fluid mechanics.

Pedagogical contribution:

"His main line of work was mathematical, however. In 1880, there was no complete text-book on hydrodynamics - Lamb's treatise had not yet matured - and a very full report by Hicks to the British Association on the progress in this subject (British Association Reports, 1881-2) greatly stimulated work in the science, and is of lasting value." *William Mitchinson Hicks 1850-1934* by S.R. Milner *Obituary Notices of the Royal Society of London* No.4, pp.392-393 December 1935.

These reports are contained in (incomplete) collected works *Mathematical Papers of W.M.Hicks: reprinted from various journals, 1873-1883*.

He may be regarded as a master of classical physics and applied mathematics who was active at the turn of the century. It should be noted, however, that he also published some works on Michelson-Morley's experiment and a generalisation of Rydberg's result in spectroscopy. In some sense, the former concerns relativity theory and the latter quantum theory.