LETTERS

Approaches to studying our history

READERS' FORUM

I share Matt Stanley's view that studying the history of our subject enriches our perspectives as practicing physicists ("Why should physicists study history?," PHYSICS TODAY, July 2016, page 38). In my talks to the nontechnical public and in presentations of new results to colleagues, I try to emphasize the complex network of chance influences, mistakes, collaborations, and controversies that lie behind discoveries conventionally caricatured by attributing them to one person.

Stanley and I part company when he complains about those who interpret the science of the past in terms of what we know today: "the bugbear of . . . Whig history." Of course, it is essential to study scientific advances in the social, economic, and cultural context of their times, as professional historians do. But Whig history is a complementary activity, justifiable on several grounds.

Our scientific predecessors are celebrated largely because of the science that their discoveries led to; that is why they are important, and why historians study them. And the significance of their science changes with time, so it is inevitable that we regard it differently as we look back: With the discovery of the Aharonov–Bohm effect, the magnetic vector potential of James Clerk Maxwell and his Victorian contemporaries takes on a new meaning. In addition, many of our famous predecessors were cleverer and wiser than us; they left "time bombs," ignored for generations until, suddenly triggered by resonating with a contemporary preoccupation, they explode.

One such time bomb is Isaac Newton's query 3, which he posed[1] after decades of struggling to accommodate Grimaldi's observation of edge diffraction fringes in his ray theory of light: "Are not the Rays of Light, in passing by the edges and sides of Bodies, bent several times backwards and forwards, with a motion like that of an Eel? And do not the three Fringes of colour'd Light above-mention'd arise from three such bendings?" Now, three centuries later, and thanks to three insights, we can understand[2] that this apparently eccentric remark makes perfect sense.

The first insight was Sommerfeld's 1896 exact solution of Maxwell's equations for light diffracted by a conducting half plane.[3] The second insight was Braunbek and Laukien's 1952 calculation[4] exhibiting Newton's eel-like undulations by plotting the trajectories of the Poynting vector in Sommerfeld's solution. The third was the recognition that those trajectories are the wave-physics counterparts of the rays of geometrical objects—an insight transferred from the analogous phase-gradient trajectories of quantum waves, as envisaged in Erwin Madelung's hydrodynamic picture or the equivalent de Broglie–Bohm representation.

Did Newton "prediscover" that ray-like representation of wave physics? Of course not, but Whig history enables us to recognize it as a prescient groping toward our modern insight—surely a legitimate way of engaging with our discipline's past.

References

1. I. Newton, *Opticks: Or, a Treatise of the Reflections, Refractions, Inflections and Colours of Light*, 4th ed., corrected (1730, republished 1952 by Dover), p. 313.
2. M. V. Berry, *Philos. Trans. R. Soc. A* **360**, 1023 (2002).
3. A. Sommerfeld, *Mathematical Theory of Diffraction*, R. J. Nagem, M. Zampolli, G. Sandri, trans., Birkhäuser (2004).
4. W. Braunbek, G. Laukien, *Optik* **9**, 174 (1952).

Michael Berry
(asymptotico@bristol.ac.uk)
University of Bristol
Bristol, UK