

## **Boscovich and Entanglement**

**Roger J Anderton**

[R.J.Anderton@btinternet.com](mailto:R.J.Anderton@btinternet.com)

Development of Newtonian physics of light as particles leads to entanglement via Boscovich.

As pointed out in my article "A unified theory of physics from the 18<sup>th</sup> Century" [1] Boscovich says that point-particles should be treated as being in pairs:

"Boscovich starts with talking about "physical point particles" which he called "puncta". He then goes on to define several other features, saying what is now interpreted as "the fields of elementary particles have associated with them a length which appears in certain respects as a minimum; this is often loosely called 'the radius of the particle'". In effect, Boscovich was saying: "Treat all finite radii as properties not of single constituent entities, but of the laws of two-body interactions." As pointed out by Whyte, this suggests that physics should stop associating radii with single particles and only consider interacting pairs or sets; in other words, physics based on a "perfectly indivisible and non-extended point", treated as a quasi-material persisting centre of interaction."

Now I note that New Scientist article by Leah Crane [2] first talks of the double slit experiment:

"In the double-slit experiment a beam of light illuminates a plate with two parallel slits in it, creating stripes of light on a screen behind."

Then points out the problem of thinking about this experiment in terms of Newtonian particles:

"Thinking of light as single particles, as Isaac Newton argued, you would expect just two bright lines, corresponding to the two slits. Instead, you get an interference pattern of many stripes."

The usual way of thinking in terms of waves versus particles, is to then think the Newtonian particle theory of light is failing for this experiment. But Leah then goes on to point out that don't have to abandon the particle theory:

"This can be explained either as two individual particles being in two places at once and interfering with themselves, or light behaving as a wave."

The "two individual particles being in two places at once" is entanglement. So, the particle theory of light is saved by entanglement. i.e. adding the concept of entanglement onto what Newton was talking about for particles of light and the theory still works; and that next step on in Newtonian theory was Boscovich saying that particles should be treated as in pairs. Although Boscovich did not mention "entanglement" – that was a term invented later; the consequences of him talking about treating particles in pairs leads to it. Full description of how modern physics arose from earlier physics has not been properly addressed, leading to such difficulties as wave-particle duality; where people might erroneously think that particle theory fails for light on certain occasions and one then

needs to use light wave theory, when it doesn't; instead the particle theory of light just needs updating to have entanglement.

### **References**

[1] A UNIFIED THEORY OF PHYSICS FROM THE 18TH CENTURY, Roger Anderton, Nexus Magazine AUGUST – SEPTEMBER 2001, p 51 -52; using: Lancelot Law Whyte (editor), Roger Joseph Boscovich, SJ, FRS, 1711–1787: Studies of his Life and Works on the 250th Anniversary of his Birth (foreword by Sir Harold Hartley), George Allen and Unwin, UK, 1961.

[2] New Scientist 5 Sept 2018 vol. 239 no.3195, p.8 Antimatter seen in two places at once, Leah Crane

c.RJAnderton7Oct2018