# Relational Blockworld Research

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As most of you know, my research area is foundations of physics, i.e., the study of conceptual and technical issues associated with quantum physics and relativity. In 2004, Professor Silberstein (Department of Philosophy) and I created a new interpretation of quantum mechanics called *Relational Blockworld* (http://users.etown.edu/s/stuckeym/RBW Overview 2014.pdf). Professor McDevitt (Department of Mathematics) joined the project in 2009 and in the summer of 2011 the three of us used RBW to explain the distant supernova data without having to invoke accelerating expansion or dark energy. Just as we were submitting our paper on this result in October, the 2011 Nobel Prize in Physics was announced "for the discovery of the accelerating expansion of the Universe through observations of distant supernovae" (http://www.nobelprize.org/nobel_prizes/physics/laureates/2011/). Our results stood up to peer review, were published[i] and then received Honorable Mention in the 2012 Gravity Research Foundation's Essay Contest[ii]. So, despite being at odds with the Nobel citation, we were vindicated. This past summer (2014), we found ourselves at odds with another high profile claim.

In the July 2014 issue of *Nature Communications*, Denkmayr *et al.* claimed[iii] to have instantiated, for the first time, the quantum Cheshire Cat experiment. In a quantum Cheshire Cat experiment[iv], a particle is spatially separated from one of its properties (Figure 1), just as the Cheshire Cat can be spatially separated from its grin in the Lewis Carroll story *Alice's Adventures in Wonderland*[v]. Since this was the year's biggest news in foundations, we wanted to include an explanation of it in our most recent paper on RBW (under construction). Much to our surprise, after digging into the calculations and experimental data, we concluded the claim was false. The process for refuting the main claim of a published paper in *Nature Communications* is to first confront the authors and see if the disagreement can be ironed out with them. After five weeks and approximately 45 pages of correspondence with the authors, they failed to convince us their main claim was true. Rather, the correspondence served to hone our objection, allowing us to meet the 600-word length constraint of a Brief Communication Arising (instrument used to refute the main claim of a published paper in *Nature Communicaitons*, in lieu of a Letter to the Editor). The entire 6000-word explanation of their experiment, to include where they made their mistakes, is under consideration at *American Journal of Physics* and is posted here http://arxiv.org/abs/1410.1522. The BCA is here http://users.etown.edu/s/stuckeym/Stuckey et al Brief Communication Arising.pdf .
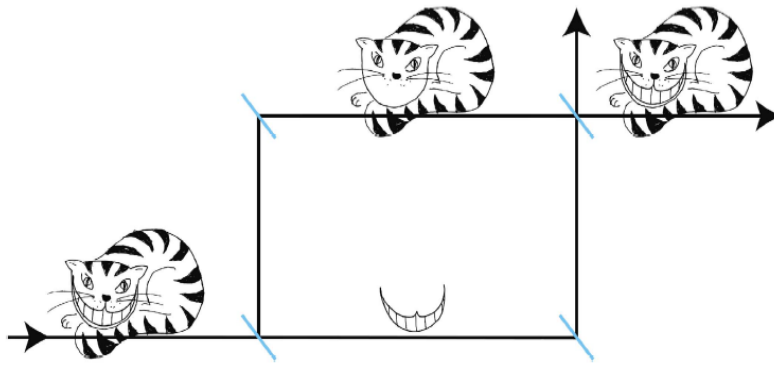
Figure 1 | Artistic depiction of the quantum Cheshire Cat. Inside the interferometer, the Cat goes through the upper beam path, while its grin travels along the lower beam path. Figure courtesy of Leon Filter.

References

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