The Register®
Biting the hand that feeds IT

Original URL: http://www.theregister.co.uk/2014/02/24/mit_wants_quasars_to_help_put_free_will_to_rest/

MIT wants quasars to help put free will to rest

Ringing the Bell on inequality

By **Richard Chirgwin**

Posted in Science, 24th February 2014 04:58 GMT

The last of three loopholes held to remain in Bell's Theorem, “setting independence”, is under the spotlight with an MIT research group saying that quasars could be used as random number generators and help prove* the validity of quantum mechanics.

(**The Register* is well aware that quantum mechanics has withstood the most rigorous tests science has been able to throw at it: there remains, however, a theoretical question that's been elusive.)

Bell's work presents one of the longest-standing tests for the validity of quantum mechanics. In a classical universe, he explained, there is a limit to the correlation between entangled particles; hence, if scientists can demonstrate non-locality, their experiments support quantum mechanics.

Enter “setting independence”, also given the shorthand “free will”: the idea that someone attempting an experiment testing quantum mechanics is unable to act completely independently of the system they're trying to measure.

To put this in the form of a question: in measuring polarisation as the basis for testing the entanglement of two photons, how can the researcher guarantee that the system they're trying to test isn't somehow influencing the instrument settings they're using for the test?

And as MIT explains here, that could create an experimental bias in favour of quantum physics.

MIT Department of Physics professor David Kaiser, postdoc Andrew Friedman, and Jason Gallicchio from the University of Chicago, believe they've come up with a scheme that would guarantee the independence of their settings: base the experiment on quasars that are so far apart, they cannot possibly have any “causal contact” in the last 14 billion years.

This means that a random characteristic of each quasar can be proven to be completely independent.

For example: having generated a pair of entangled particles, the researcher needs to work out what characteristic is to be tested for each of them. Instead of (say) tossing a coin to make the decision for each particle, a telescopic observation of a very distant quasar would be used instead.

“In other words, quasar A determines the settings to detect particle A, and quasar B sets the detector for particle B,” MIT states. “If, after multiple measurements with this experimental setup, scientists found that the measurements of the particles were correlated more than predicted by the laws of classical physics, Kaiser says, then the universe as we see it must be based instead on quantum mechanics."

The researchers believe that experiments could be designed using today's technology – which means that the last "nonlocality" loophole may be on the way to getting a test. ®

Related stories

Quantum comms can be made even more secure (18 February 2014)
http://www.theregister.co.uk/2014/02/18/quantum_comms_can_be_made_even_more_secure/
Japanese quantum boffins 'may have the key to TELEPORTATION' (30 January 2014)
http://www.theregister.co.uk/2014/01/30/boffins_bust_quantum_teleportation_distance_limit/
Quantum crypto pitches for data centre links (5 December 2013)
http://www.theregister.co.uk/2013/12/05/quantum_crypto_pitches_at_data_centre_links/
Noisy qubits destroy data in order to save it (26 November 2013)
http://www.theregister.co.uk/2013/11/26/noisy_qubits_dump_unwanted_data/
QUANTUM COMPUTER in WORLD RECORD qubit stunner (15 November 2013)
http://www.theregister.co.uk/2013/11/15/boffins_break_record_to_show_quantum_computing_isnt_too_cool_for_school/
Boffins demo on-chip entanglement at macro scale (17 September 2013)
http://www.theregister.co.uk/2013/09/17/qld_uni_boffins_demo_onchip_entanglement_at_macro_scale/
Cavemen innocent in MAMMOTH MURDER case: DNA evidence (11 September 2013)
http://www.theregister.co.uk/2013/09/11/wooly_mammoths_killed_by_climate_change/
Brit and Danish boffins propose NSA-proof crypto for cloud computing (10 September 2013)
http://www.theregister.co.uk/2013/09/10/boffins_propose_more_spookproof_crypto/
Quantum crypto nearly ready to go mobile (29 August 2013)
http://www.theregister.co.uk/2013/08/29/quantum_crypto_nearly_ready_to_go_mobile/
Quantum crypto - with nothing more than STANDARD broadband fibre (20 November 2012)
http://www.theregister.co.uk/2012/11/20/quantum_crypto_breakthrough/
Boffins receive quantum key from moving plane (17 September 2012)
http://www.theregister.co.uk/2012/09/17/qkd_from_moving_airplane/
'Quantum Trojans' undermine security theory (29 January 2012)
http://www.theregister.co.uk/2012/01/29/quantum_key_schemes_vendor_mitm/
Quantum crypto for consumer GPON (19 July 2011)
http://www.theregister.co.uk/2011/07/19/qkd_for_consumer_gpon/
Quantum crypto felled by 'Perfect Eavesdropper' exploit (20 June 2011)
http://www.theregister.co.uk/2011/06/20/quantum_crypto_hack/
Quantum crypto experts dispute potency of 'blinding' hack (7 December 2010)
http://www.theregister.co.uk/2010/12/07/quantum_crypto_attack_dispute/