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Timelike Nonseparability and Retrocausation

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Abstract

Renewed interest in the quantum zigzagging causality model is highlighted by an ingenious proposal by Suarez to test the timelike aspect of nonseparability. Taking advantage of a work by Fröhner I argue that Ψ, the Dirac representation of a state, has the Bayesian-like connotation of best estimate given the Hilbert frame chosen. As a measurement perturbs uncontrollably a system it is (Hoekzema's wording) a *retroparation*. My bet is that Suarez' sources and sinks of paired particles operating inside the coherence length of the laser beam will evidence retrocausation.

Keywords: zigzagging causality, measurement as retroparation, Ψ as best estimate given the Hilbert frame chosen, "veiled reality".

1. Whenever chance occurrences show up as spacetime events, correlated probabilities imply (via Bayes reversible formula) reciprocally telegraphed information. Relativistic covariance is then exigible.

Fourier analysis steps in; Fröhner [1], in an interesting paper, argues that it is inherent in the probability formalism.

For the chance events handled by statistical mechanics the phase cell is crucial, and its magnitude has physical meaning. De Broglie, updating a deep remark of Hamilton and others (Klein,1890; Vessiot,1906), likened action to phase via Planck's constant. Heisenberg, Fourier-associating position and momentum, quantified the phase cell. Finally Born showed that probability is a keystone in the transition from geometric to wave mechanics. Fröhner's guided tour of the story uses Hamilton's equations in place of the Hamilton-Jacobi extremum law.

Quantum mechanics is thus viewed as being jointly the physical statistical mechanics and the physical telegraphic network. The Bayesian reversal of joint probabilities entails action-reaction reciprocity for spacelike separated events and cause-effect reversibility for timelike separated ones. Retrocausation is thus legalized.

Information pertaining to veiled reality is telegraphed via de Broglie waves. The Ψ, Dirac's representation of a state, has the Bayesian connotation of estimate of the state given the Hilbert reference frame chosen -the one fitting the *preparing* or *retroparing* [2] device parading as a macroscopic "object".

So Dirac's *bra* or *ket* expresses a telegraphable information (transition amplitudes including the propagator [3]). The much commented upon "sum-and-product rule of amp-litudes" stems from a limitation in the telegraph. Fröhner, and before him Barut [4], assuming hiddenness of a prepared EPRB spin zero state, derive classically the correlation formula. How is this possible? Fröhner answers: "Quantum mechanics looks like an error propagating formalism for uncertainty afflicted systems obeying the classical equations of motion".

Experimentation invalidates one EPR [5] or Bell [6] assumption: A quantum measurement or observation unveil's not a preexisting magnitude but, perturbing the system, contributes in its realization. Wheeler's [7] "delayed choice experiments" stress this; for instance, "measuring an electron spin" implies *first* aligning it arbitrarily, *second* retroparing it as $\pm\frac{1}{2}h$. All this was part of the twenties refrain, and should not have been forgotten.

2. A measurement thus is a reversed preparation -a *retroparation* [2]. Such is the basis of the zigzagging causality model of EPR correlations [8]. As the correlated measured magnitudes do not preexist in the prepared state, retrocausation is implied by definition. The EPR phenomenology pinpoints the faulty EPR assumption: not identifying measurement as retroparation.

The concise derivation [3] of the EPRB formula thus allowed is valid for both [9] space or time distant occurrences. Sutherland [8] (a member of the zigzagging causality club) temporarily resigned in 1985, frightened as he was by the radicality of *retrocausation* in the timelike case; now Tapster et *al* [10] have evidenced it.

3. This author deems fundamentally deficient any analysis of "quantum philos-

ophy" that is not explicitly *Lorentz-and-CPT invariant*; he suspects it to conceal important phenomena. So he bets that Suarez [11] very ingenious proposed test of timelike non-separability will vindicate the zigzagging causality model; he feels that the sources and sinks of photons operating inside the coherence length of the laser beam will exhibit timelike nonseparability.

References

[1] F.H. Fröhner, The Riesz-Fejer Theorem: Missing Link Between Probaility Theory and Quantum Mechanics, *Wissenschaftliche Berichte FZKA 5888*, Forschungszentrum Karlsruhe.

[2] D. Hoekzema, *Found. Phys.* 22 (1992) 467.

[3] O. Costa de Beauregard, *Phys. Rev. Lett.* 50 (1983) 867 ; also *Foundations of Quantum Mechanics in the Light of New Technology*, S. Kamefuchi et al eds, Phys. Soc. Japan Tokyo 1983, p. 233.

[4] A. Barut, *Waves and Particles in Light and Matter*, A. van der Merwe and A. Garuccio eds, Plenum Press (1994) p. 9.

[5] A. Einstein, B. Podolsky and N. Rosen, *Phys Rev.* 47 (1935) 777.

[6] J.S. Bell, *Physics* 1 (1965) 195.

[7] W.A. Misner and J.A. Wheeler, *Foundations of Quantum Mechanics in the Light of New Technology*, S. Kamefuchi et al eds, Phys. Soc. Japan, Tokyo 1983 , p. 140.

[8] O. Costa de Beauregard, *C.R. Acad. Sci.* 236 (1953) 1632 ; H.P. Stapp, *Nuovo Cim.* 29 B (1975) 270; W.C. Davidon, *Nuovo Cim.* 36 B (1976) 34; K.V. Roberts, *Proc. Roy. Soc.* A 360 (1978) 135; C.W. Rietdijk, *Found. Phys.* 8 (1978) 615; J. Rayski, *Found. Phys.* 9 (1979) 217 ; J.G. Cramer, *Phys. Rev.* D 22 (1980) 362 and *Rev. Mod. Phys.* 58 (1986) 647 ; R.I. Sutherland, *Intern. J. Theor. Phys.* 22 (1983) 377 and *Nuovo Cim.* 88 B (1985) 114 ; N. Hokkyo, *Found. Phys. Lett.* 2 (1989) 395 and 7 (1994) 365. D.J. Hoekzema, *Found. Phys.* 22 (1992) 467 and 487.

[9] O. Costa de Beauregard, *Found. Phys. Lett.* 5 (1992) 489.

[10] P.R. Tapster, J.G. Rarity and P.C.M. Owens, *Phys. Rev. Lett.* 73 (1994) 1923.

[11] A. Suarez, Does quantum mechanics imply influences acting backward in time?, *quant-ph/9801061.*