

Abstract Submitted
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Time-asymmetry and causal structure BOB COECKE, RAYMOND LAL, Oxford University — We consider devices with two inputs and two outputs, Alice and Bob each having access to one input and one output. To such a device we associate time-reverses by exchanging the roles of the inputs and the outputs. We find that there are devices which admit a local hidden variable representation, but for which time-reverses enable perfect signaling between Alice and Bob. That is, a “perfect channel in one time direction” becomes a “non-channel in the other direction.” Also, for PR boxes time-reverses enable signaling between Alice and Bob, but never as a perfect channel. This result has several consequences. Firstly, it establishes that the arrow of time can be read from signaling structure: signaling means backward in time. It undermines the representation of causal structures as partial orders or similar ‘time-symmetric structures’, as is often assumed in search of a theory of quantum gravity. They also provide new insights into the structure of the polytope of generalized probabilistic correlations, hence on theories more general than quantum theory. Finally, it contributes to the growing area of research into quantum information processing in relativistic spacetimes. Ref: arXiv:1010.4572

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