SEMINAR: What makes a causal loop consistent?

HIPPOLYTE DOURDENT

October 29, 2026
12:00 to 13:00
Seminar Room

Extremely popular in science-fiction, causal loops are also seriously studied in fundamental physics, since general relativity does not forbid them. Their notoriety is entangled with the grandfather paradox: a (hypothetically) physical contradiction in which a cause suppresses its own effect. What principle, then, prevents causal loops from generating such paradoxes? In an information-theoretic framework, the answer is formalized as a logical consistency principle: a causal loop should always generate valid probabilities under arbitrary independent local interventions by agents. But how can consistency be certified? Could it be characterized intrinsically, in terms of the loop alone, without reference to the agents acting on it?

I will show that, for classical deterministic processes, logical consistency is found to hold exactly when the list of events is pairwise exclusive and complete. This yields the first event-based, intervention-free, non-recursive characterization of consistent causal loops. It also reveals that the most general form of single-round, deterministic, classical communication allowed by logic is completely captured by a multipartite form of Specker's principle, which plays a central role in explaining why quantum correlations are not more nonlocal than they are. Finally, I will explain how the Acin-Fritz-Leverrier-Sainz hypergraph representation of Bell scenarios recasts these causal loops as a non-standard way of composing no-signaling black boxes.

Based on: https://arxiv.org/abs/2609.39735 ; https://arxiv.org/abs/2610.23367

Hosted by: Prof. Dr. Antonio Acin