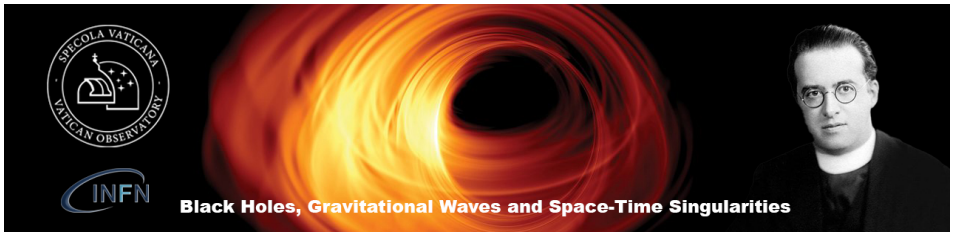

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Mapping the road from the Planckian end

Monday 17 June 2024 15:40 (40 minutes)

Where may genuinely new insights on the origin of our universe still come from today? Is there an unexplored part of theory space not beset by countless ambiguities, free parameters or ad-hoc assumptions? I will argue that this place is full, nonperturbative quantum gravity based on the gravitational path integral. It requires geometry beyond Riemann, but sticks with the fundamental tenets of quantum field theory. Its key computational tool is lattice quantum gravity, the gravitational analogue of lattice QCD, in its modern formulation of causal dynamical triangulations. It has allowed us to measure diffeomorphism-invariant observables and uncover universal properties of gravity at the Planck scale, which often run counter to semiclassical intuition. Among them is the remarkable dynamical emergence of a quantum universe with de Sitter-like properties from pure 'quantum foam'. Recent progress on nonperturbative two-point functions opens the exciting prospect of deriving predictions for the early quantum universe from first principles.

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