Small scale structure of spacetime and it's ramifications

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Existence of a lower bound, say ℓ_0, to spacetime intervals arises very generically when one attempts to combine the basic principles of quantum theory and general relativity. I argue that incorporating such a length scale in a Lorentz covariant manner requires a description of spacetime geometry in terms of non-local bi-tensors $q_{ab}(x, y)$ rather than the conventional metric tensor $g_{ab}(x)$. I show how such a description can be achieved by reconstructing the spacetime using the Synge world function and the van Vleck determinant. Using these, I demonstrate that the same non-analytic structure of the reconstructed spacetime which renders a perturbative expansion in ℓ_0 meaningless, will also generically leave a non-trivial "relic" in the limit $\ell_0 \to 0$. I present specific results where such a relic term is manifest, and discuss several implications of the same. I also briefly comment on the possibility of integrating these results within a scenario in which the spacetime becomes Euclidean at small scales.

I will conclude by discussing the ramifications of these ideas in classical and quantum gravity, and what it implies for the (semi-)classical limit of any quantum gravity framework.

The talk will be essentially based on work that has been systematically developed in: **1307.5618**, **1405.4967**, **1408.3963**, **1503.03793**, **1507.05669**, **1705.02504**, **1802.07055**.