## **Proca seminars series**



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## UV-IR connections in scattering amplitudes: power of unitarity and causality

Wednesday 28 February 2024 10:00 (1h 30m)

Very basic assumptions about the structure of the fundamental theory describing the nature at high energies can allow for a set of valuable constraints on the low energy EFT. The constraints are independent of the concrete underlying fundamental theory at high energies. The low energy physics is bounded from the set of quite natural assumptions about the structure of the full theory, such as unitarity, causality and Lorentz invariance. In this talk I will consider the EFT of photons (or other U(1) gauge field) and compare different approaches to obtain bounds on its Wilson coefficients. I will present an analytic derivation of the implications of unitarity (linear and non-linear positivity bounds) and compare these constraints with the requirement of causal propagation of the photon modes around non-trivial backgrounds generated by external sources. I will show that the low energy causality condition can give complementary constraints to the positivity bounds. Applying both constraints together can significantly reduce the allowed region of the photon EFT parameters. Besides constraints on the IR theory, the analyticity and unitarity assumptions can set bounds on the UV theory. I will show this connection using the example of the graviton mediated scattering amplitudes. Surprisingly, the form of the forward limit singularities at low energies can give an insight into the of high energy limit of graviton scattering described by the unknown physics.

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