Local loop-level recursion for nonplanar theories

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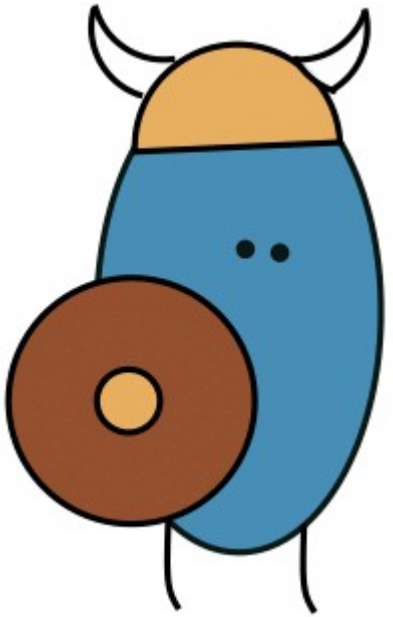
SAGEX

Scattering Amplitudes:
from Geometry to Experiment

Ingrid Holm from Norway



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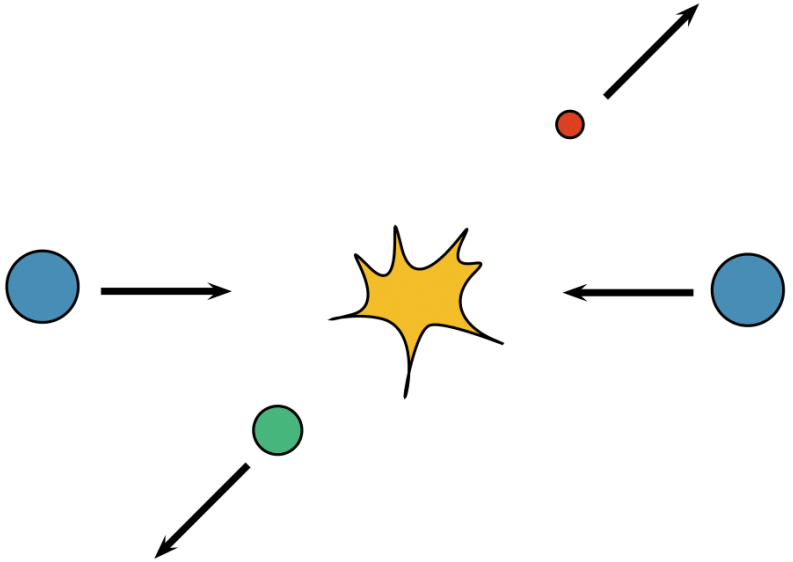

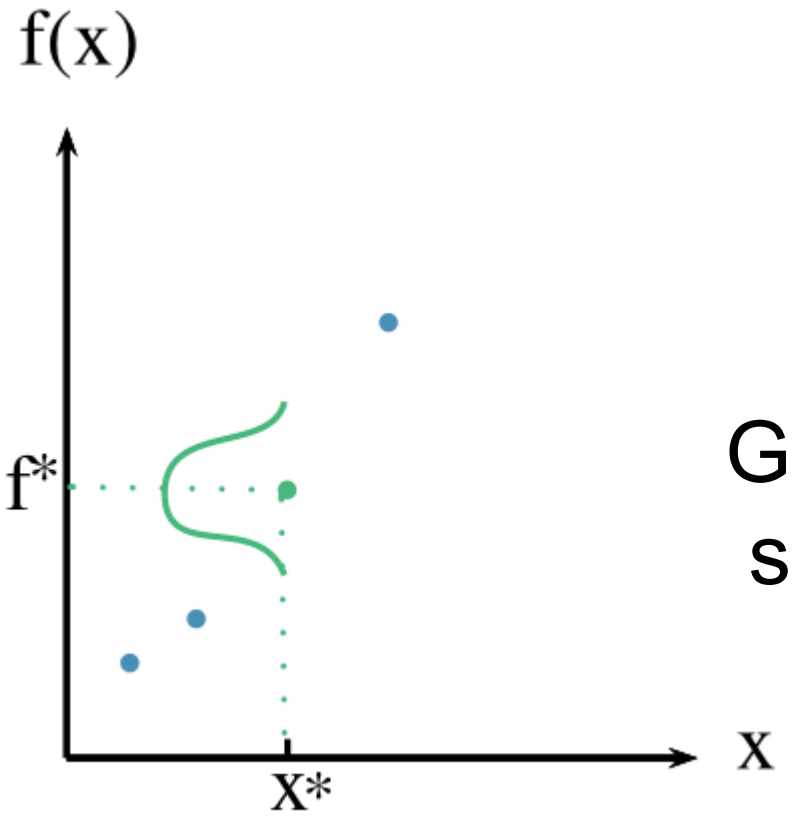

Gaussian processes to evaluate supersymmetric cross sections

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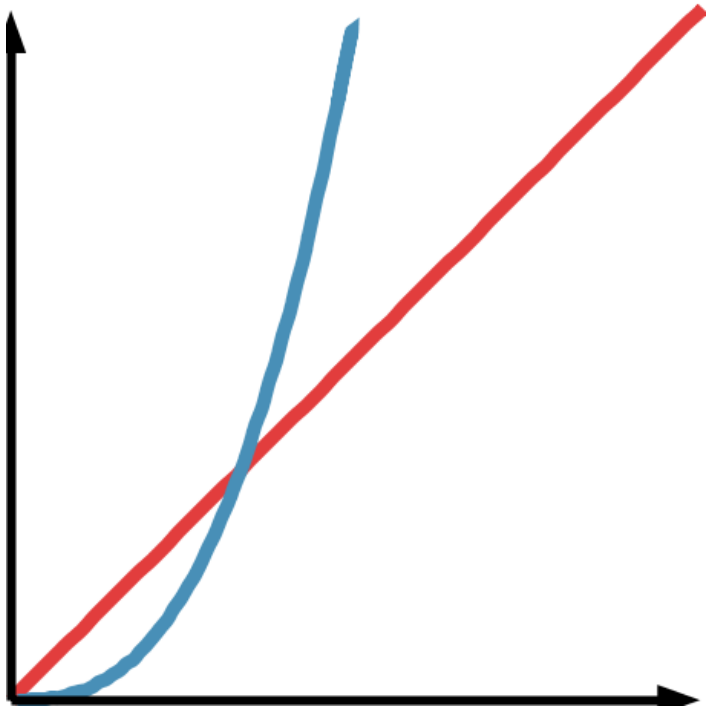
Factorial increase in complexity with multiplicity and loop order



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The integrand of a gauge theory's graph can be written as

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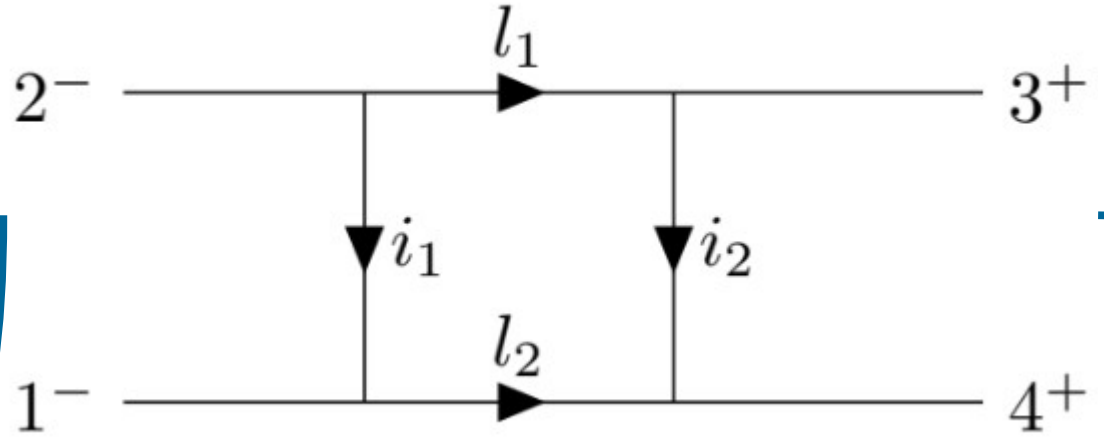

$$d = \frac{1}{l_1^2 l_2^2 i_1^2 i_2^2} \qquad c = f^{1 i_1 l_2} f^{2 l_1 i_1} f^{3 i_2 l_1} f^{4 l_2 i_2}$$

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For gauge theories we can deal with **color-ordered trees**

$$\mathcal{A}_m^{\text{tree}}(12\ldots m) = \sum_{\sigma\in\text{perm}(2\ldots m)} \text{Tr}\left(\text{T}^{a_1}\text{T}^{a_{\sigma(2)}}\text{T}^{a_{\sigma(3)}}\ldots\text{T}^{a_{\sigma(m)}}\right) A_m^{\text{tree}}(1,\sigma)$$

$$A_m^{\text{tree}}(1,\sigma) = \sum_{g\in\Gamma_{m,\sigma}^{\text{tree}}} \frac{n(g)}{d(g)}$$

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Build higher-loop integrands from tree amplitudes using **unitarity cuts**

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The **double copy** structure of gravity theories allows us to write

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Reproduce a unitarity cut on the one-loop gauge and gravity box diagrams

On the Relationship between Yang-Mills Theory and Gravity and its Implication for Ultraviolet Divergences

Z. Bern[⋆,1], L. Dixon[†,2], D.C. Dunbar[♯,3], M. Perelstein[†,2] and J.S. Rozowsky[⋆,1]

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ArXiv: hep-th/9802162

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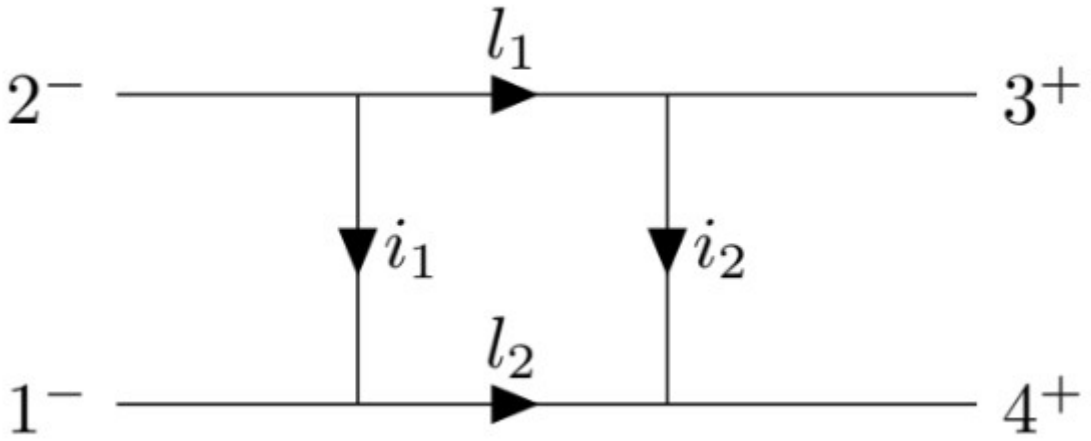
Reproduce a unitarity cut on the one-loop gauge and gravity box diagrams



$$ist A_4^{\text{tree}}$$

$$\left[ist A_4^{\text{tree}}\right]^2$$

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Thank you!

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