

# Massive Scattering Amplitudes for Standard Model: On-shell Massless-Massive Correspondence and the On-shell Higgsing

We present a comprehensive exploration of the on-shell Higgs mechanism using the massless-massive correspondence (MMC) applied to scattering amplitudes in the Standard Model. The MMC, integrated with power counting based on the  $v/E$  expansion (where  $v$  denotes the electroweak vacuum expectation value (VEV)), is derived from spinor splitting and energy scaling of massive amplitudes. For an  $n$ -point massive amplitude  $\mathcal{M}_n$ , its energy scaling is categorized as  $[\mathcal{M}_n]_l \sim E^{4-n}(v/E)^l$ , aligning it with an  $(n+l)$ -point massless amplitude  $\mathcal{A}_{n+l} \sim [\mathcal{M}_n]_l$ . The Higgs mechanism is reflected in all order matching ( $l \geq 0$ ). Notably, when  $l > 0$ , the additional  $l$  Higgs bosons in  $\mathcal{A}_{n+l}$  manifest as VEVs in the infrared (IR), thereby matching  $\mathcal{A}_{n+l}$  to  $[\mathcal{M}_n]_l$ . This transition, elucidating how the surplus Higgs bosons at high energy contribute to VEVs at low energy, is called the on-shell Higgsing mechanism.

**Primary authors:** 于, 江浩 (中科院理论所); 倪, 郁涵 (I); 邬, 超 (ITP, CAS)

**Presenter:** 倪, 郁涵 (I)

**Session Classification:** 分会场一

**Track Classification:** TeV 物理和超出标准模型新物理