Studies of anomalous quartic gauge boson couplings sensitivity at future colliders.

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Within the Standard Model(SM), the non-Abelian SU(2)×U(1) structure of the electroweak sector completely specifies the structure of the electroweak gauge boson self-couplings. As such, any deviations from this expectation could indicate the presence of new physics phenomena. The study of multiboson production therefore provides a unique approach to search for hints of new physics processes that may exist at higher energy scales.

Possible new physics effects can be characterized in a model independent way within a SM Effective Field Theory (SMEFT); an approach that has been shown to be a key tool to systematically explore the unknown using the data currently available (see e.g. [1]).

Within the framework of a SMEFT, the effective Lagrangian is extended to include higher dimension operators. In particular, anomalous quartic gauge couplings can arise from both dimension-6 and dimension-8 operators. At dimension-6, both quartic and triple gauge boson vertices are generated with related coefficients; pure quartic boson couplings arise instead at dimension-8 assuming a linear realization of the gauge symmetry [2]. Since trilinear gauge boson couplings have been measured to agree with the SM within a few percent (see e.g. [3–5]), and yet new physics effects could be suppressed in triple gauge interactions as compared to quartic ones, it is therefore important to study all possibly realizable quartic gauge couplings.

We are interested in exploring the complementarity of different proposed future collider projects, and their respective sensitivity, to new physics contributions to anomalous quartic gauge couplings. Specifically, our investigations will initially focus on the study of the $WW\gamma\gamma$ quartic gauge coupling. Time and resources permitting, the work may be extended with the ultimate goal of preparing a comprehensive survey of physics processes, at different future colliders, with the best sensitivity to new physics contributions arising from

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dimension-8 operators. The results of this work will contribute to the assessment of the physics potential of future collider research programs.

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