

Exploring the dualities of massive gauge theories: A_μ vs. $B_{\mu\nu}$

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We compare the massive Kalb-Ramond and Proca fields with a quartic self-interaction and show that the same strong coupling scale is present in both theories. In the Proca theory, the longitudinal mode enters the strongly coupled regime beyond this scale, while the two transverse modes propagate further and survive in the massless limit. In contrast, in case of the massive Kalb-Ramond field, the two transverse modes become strongly coupled beyond the Vainshtein scale, while the pseudo-scalar mode remains in the weak coupling regime and survives in the massless limit. This indicates a contradiction with numerous claims in the literature which state that the massive Kalb-Ramond and Proca theories are dual to each other.

Orateur: HELL, Anamaria (LMU Munich)

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