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Low-energy limit of SMEFT applied to the $\tau^- \longrightarrow (K\pi)^- \nu_\tau$ decays

We analyze the $\tau^- \longrightarrow (K\pi)^- \nu_\tau$ decays within an effective field theory description of heavy new physics (NP) modifying the SM left-handed weak charged current and include refined SM input (with controlled uncertainties) for the participant meson form factors exploiting chiral symmetry, dispersion relations and data. We include the leading dimension six operators and work at linear order in the effective couplings. Within this setting we:
i) confirm that it is impossible to understand the BaBar anomaly in the CP asymmetry measurement (we find an upper bound for the NP contribution slightly larger than in Phys. Rev. Lett. 120 (2018) no.14, 141803, but still irrelevant compared to the experimental uncertainty by four orders of magnitude approximately);
ii) first show that the anomalous bump present in the published Belle data for the $K_S\pi^-$ invariant mass distribution close to threshold cannot be due to heavy NP;
iii) first bind the heavy NP effective couplings using $\tau^- \longrightarrow (K\pi)^- \nu_\tau$ decays and show that they are competitive with those found in hyperon semileptonic decays. Although they are not at the level found in semileptonic Kaon decays for the non-standard scalar contributions, they are competitive with Kaon and LHC data for the NP tensor interactions.
We also compare the SM predictions with the possible deviations caused by NP in a couple of Dalitz plot distributions, in the forward-backward asymmetry and in the di-meson invariant mass distribution and discuss the most interesting measurements to be performed at Belle-II using these decays data.

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