

# The $\tau^- \rightarrow \eta^{(\prime)} \pi^- \nu_\tau \gamma$ decays as backgrounds in the search for second class currents

## Abstract

Observation of  $\tau^- \rightarrow \eta^{(\prime)} \pi^- \nu_\tau$  decays at Belle-II would indicate either a manifestation of isospin symmetry breaking or genuine second class currents (SCC) effects. The corresponding radiative  $\tau^- \rightarrow \eta^{(\prime)} \pi^- \nu_\tau \gamma$  decay channels are not suppressed by  $G$ -parity considerations and may represent a serious background in searches of SCC in the former. We compute the observables associated to these radiative decays using Resonance Chiral Lagrangians and conclude that vetoing photons with  $E_\gamma > 100$  MeV should get rid of this background in the Belle-II environment searching for the  $\tau^- \rightarrow \eta \pi^- \nu_\tau$  channel. Similar considerations hold inconclusive for decays involving the  $\eta'$  given the theory uncertainties in the prediction of the  $\tau^- \rightarrow \eta' \pi^- \nu_\tau$  branching ratio. Still, additional kinematics-based cuts should be able to suppress this background in the  $\eta'$  case to a negligible level.

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