



Contribution ID: 97

Type: not specified

Weak radiative pion vertex in $\tau^- \rightarrow \pi^- l^+ l^- \nu_\tau$ decay

Tuesday, 10 September 2013 14:05 (3h 25m)

We carry out a detailed study of the branching fractions and lepton pair invariant-mass spectrum of $\tau^- \rightarrow \pi^- \nu_\tau l^+ l^-$ decays ($l=e, \mu$). In addition to the model-independent (QED) contributions, we include the structure-dependent (SD) terms, which encode information on the hadronization of QCD currents. The form factors describing the SD contributions are evaluated by supplementing Chiral Perturbation Theory with the inclusion of the lightest multiplet of spin-one resonances as active degrees of freedom. The Lagrangian couplings have been determined demanding the known QCD short-distance behaviour to the relevant Green functions and associated form factors in the limit where the number of colours goes to infinity. As a result, we predict $BR(\tau^- \rightarrow \pi^- \nu_\tau e^+ e^-) = (1.7^{+1.1}_{-0.3}) \times 10^{-5}$ and $BR(\tau^- \rightarrow \pi^- \nu_\tau \mu^+ \mu^-) = [0.03, 1.0] \times 10^{-5}$. According to this, the first decay could be measured in the near future, which is not granted for the second one.

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Session Classification: Poster session