Vector and Axial Vector Pion Form Factors

MICHAEL VITZ, Univ of Virginia, PEN COLLABORATION — Radiative pion decay $\pi^+ \rightarrow e^+\nu\gamma$ (RPD) provides critical input to chiral perturbation theory ($\chi$PT). Aside from the uninteresting “inner bremsstrahlung” contribution from QED, the RPD rate contains “structure dependent” terms given by $F_V$ and $F_A$, the vector and axial-vector pion form factors, respectively. The two appear in the decay rate in combinations $F_V - F_A$ and $F_V + F_A$, i.e., in the so-called $SD^-$ and $SD^+$ terms, respectively. The latter has been measured to high precision by the PIBETA collaboration. We report on the analysis of new data, measured by the PEN collaboration in runs between 2008 and 2010 at the Paul Scherrer Institute, Switzerland. We particularly focus on the possibility of improvement in the determination of the $SD^-$ term. Precise determinations of $F_V$ and $F_A$ test the validity of the CVC hypothesis, provide numerical input for the $l_9 + l_{10}$ terms in the $\chi$PT lagrangian, and constrain potential non-$(V - A)$ terms, such as a possible tensor term $F_T$.

1 NSF grants PHY-0970013, 1307328, and others.
3 http://pen.phys.virginia.edu