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Manifestation of the electric dipole moment in the decays of τ leptons produced in e+e– annihilation

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CP-odd asymmetries in the processes $e^+e^- \to \tau^+\pi^-\nu_\tau$, $e^+e^- \to \pi^+\tau^-\bar\nu_\tau$, $e^+e^- \to \tau^+\rho^-\nu_\tau$, $e^+e^- \to \rho^+\tau^-\bar\nu_\tau$, $e^+e^- \to \tau^+e^-\nu_\tau\bar\nu_e$, and $e^+e^- \to \tau^-e^+\nu_e\bar\nu_\tau$ are investigated with account for longitudinal polarization of electron (or positron) beam. These asymmetries are a manifestation of electric dipole form factor $F_3^\tau \equiv b$ in the $\gamma\tau^+\tau^-$ vertex. It is shown that to measure $\mathrm{Im}\, b$ in the specified processes, polarization is not needed, while to measure $\mathrm{Re}\, b$ it is required. The processes $e^+e^- \to \pi^+\pi^-\nu_\tau\bar\nu_\tau$, $e^+e^- \to e^+e^-\nu_\tau\bar\nu_\tau\nu_e\bar\nu_e$, $e^+e^- \to \mu^+\mu^-\nu_\tau\bar\nu_\tau\nu_\mu\bar\nu_\mu$, $e^+e^- \to \mu^+e^-\nu_\tau\bar\nu_\tau\nu_\mu\bar\nu_e$, and $e^+e^- \to \mu^-e^+\nu_\tau\bar\nu_\tau\nu_e\bar\nu_\mu$ are also discussed for the case of unpolarized electron and positron beams. In the latter cases it is possible to measure $\mathrm{Re}\, b$ using the differential cross section over momenta of both registered particles.

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