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Recent results on kaon physics from the OKA experiment

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The talk is devoted to the latest results from the OKA collaboration. The OKA setup is using the RF-separated 17.7 GeV/c momentum kaon beam of the U-70 accelerator. The data corresponds to the flux of $2.62 \cdot 10^{10}$ «live» kaons entering the decay volume. A missing mass analysis is performed to search for an invisible pseudoscalar axion-like particle (ALP) in the decay $K^+ \rightarrow \pi^+ \pi^0 a$. No signal is observed, the 90% CL upper limit is changing from $2.5 \cdot 10^{-6}$ to $2 \cdot 10^{-7}$ for the ALP mass from 0 to 200 MeV. Several rare EM decays are investigated: A new precise measurement of the vector and axial-vector form factor difference $F_V - F_A$ in the $K^+ \rightarrow \mu^+ \nu \gamma$ decay is reported. About 144K events are selected. The preliminary result is $F_V - F_A = 0.135 \pm 0.017(stat) \pm 0.024(syst)$ which differs by $\sim 3\sigma$ from $PT(O(p^4))$ and by 1.5σ from the Lattice calculations. The $K^+ \rightarrow \mu^+ \nu \pi^0 \gamma (K\mu 3\gamma)$ decay is studied with the high statistics of more than 1000 signal events with the energy of the emitted photon in the rest frame of the decaying kaon $E_\gamma > 30$ MeV. Using $4.48 \cdot 10^6$ events of the decay the ratio $Br(K\mu 3\gamma)/Br(K\mu 3)$ is found to be $(4.45 \pm 0.25(stat)) \cdot 10^{-4}$. From this value, using $Br(K\mu 3) = 3.352\%$ we get $Br(K\mu 3\gamma) = (1.492 \pm 0.085(stat)) \cdot 10^{-5}$. Our result is preliminary, with systematic errors being estimated. A rare EM decay $K^+ \rightarrow \pi^+ \pi^0 \pi^0 \gamma$ is observed for the first time on the statistics of ~ 50 events with $E_\gamma > 10$ MeV. The branching is measured to be $Br = (3.7 \pm 0.9 \pm 0.3) \cdot 10^{-6}$ $E_\gamma > 10$ MeV. A super-rare EM decay $K^+ \rightarrow e^+ \nu \pi^0 \pi^0 \pi^0$ is searched for, no events were observed, the upper limit set is: $Br < 5 \cdot 10^{-8}$, ~ 60 times better than in the previous searches.

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