Conclusions

The Standard Model (SM) predicts that the photon emitted in $b \rightarrow s\gamma$ transitions is predominantly left-handed. While the measured inclusive $b \rightarrow s\gamma$ rate agrees with the SM calculations, no direct evidence exists for a nonzero photon polarization $A_\gamma$ in this type of decays. Several extensions of the SM, compatible with all current measurements, predict that the photon acquires a significant right-handed component.

In $B^+ \rightarrow K^+\pi^+\pi^-\gamma$ decays, information about the photon polarization is obtained from the angular distribution of the photon direction with respect to the plane defined by the momenta of the three final-state hadrons in their centre-of-mass frame.

The up-down asymmetry $A_{ud}$ between the number of photons found in each side of the plane is expected to be proportional to the photon polarization $A_\gamma$.

$$A_{ud} = c_1 - c_2 / 4$$

Combining the four independent results for $A_{ud}$, a 5.2$\sigma$ significance for the photon polarization to be different from zero is obtained.