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Neutral pion bumps in TeV spectra of X-ray flaring blazars

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Very high-energy (VHE, $E > 100$ GeV) observations of blazar Mrk 501 with MAGIC in 2014 have revealed an unusual narrow spectral feature at ~3 TeV during an extreme X-ray flaring activity. The one-zone synchrotron-self Compton scenario, widely used in blazar broadband spectral modeling, fails to explain the narrow TeV component. Motivated by this rare observation, we propose an alternative model where narrow features in VHE blazar spectra result from the decay of neutral pions (π^0 bumps). These are in turn produced by interactions of protons with hard X-ray photons (> 50 keV) whose number density can increase during flares. No π^0 bumps are predicted in X-ray "quiescense", as the proton energy is not high enough to exceed the threshold for pion production. We explore the physical conditions needed for the emergence of narrow π^0 bumps in blazar VHE spectra and discuss their detectability with the Cherenkov Telescope Array.

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