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Probing a signature of multiple recollimation shocks in the blazar Markarian 421. DAVID WILLIAMS, OLIVIER HERVET, University of California, Santa Cruz, ABRAHAM FALCONE, AMANPREET KAUR, Pennsylvania State University — Markarian 421, like most of the TeV high-frequency-peaked BL Lacs (HBLs), shows slow or no motion of the VLBI radio-knot structures in its jet, in stark contrast to its known fast variability. This problem, known as "the bulk Lorentz factor crisis," can be resolved if we consider that these strings of knots are successive recollimation shocks in the jet. Successive shocks predict that a unique pattern of the non-thermal emission variability should appear after each strong flare. Using the 13-year-long X-ray dataset from the Swift X-ray Telescope, we find evidence of such a distinct pattern with a statistical significance of more than 3 standard deviations compared to variability from stochastic fluctuations. We show how this pattern can be used in an innovative way to unveil the physical properties of the Mrk 421 jet, such as the apparent flow speed, the size of jet perturbations, and the jet beaming parameters. We discuss how this study can be extended to other wavelengths.

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