

Beyond the Standard Model searches with the Highest Energy Gamma rays with SWGO

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The Southern Wide-field Gamma-ray Observatory (SWGO) is a proposed next generation gamma-ray observatory that would be located in the Southern hemisphere. SWGO will be a continuously monitoring survey instrument with a wide field of view. It will be the most sensitive gamma-ray observatory above 20 TeV in the Southern hemisphere. With this high-energy reach SWGO will be able to search for Axion Like Particles and Lorentz Invariance Violation. We will present the expected sensitivity of SWGO to these searches.

- The Southern Wide-Field Gamma-ray Observatory (SWGO) is a proposed further gamma-ray observatory that will
 - Measure extensive air showers with cherenkov detection technique
 - Be the most sensitive gamma-ray observatory in the southern hemisphere above ~10 TeV
 - Observe gamma rays >PeV allowing sensitive probes to Beyond the Standard Model (BSM) physics
 - For more info see swgo.org and [arXiv:1902.08429](https://arxiv.org/abs/1902.08429)
- Axion Like Particle Searches
 - Gammas to ALPs in Galaxy Clusters which travel unattuated to Milky Way where they convert back to gammas producing a high-energy tail in the spectrum
 - ALPs are a non-WIMP dark matter candidate
 - Given its high-energy sensitivity, SWGO will be sensitive to ALP effects from sources like 1ES 0414+009 (Figure 1)
- Lorentz Invariance Violation (LIV)
 - If there is LIV then photons would become unstable and decay
 - The existence of high-energy gamma rays set constraints on the energy scale of LIV
 - With its high-energy reach SWGO should see PeV photons if they exist and set world-leading limits on LIV (Figure 2)

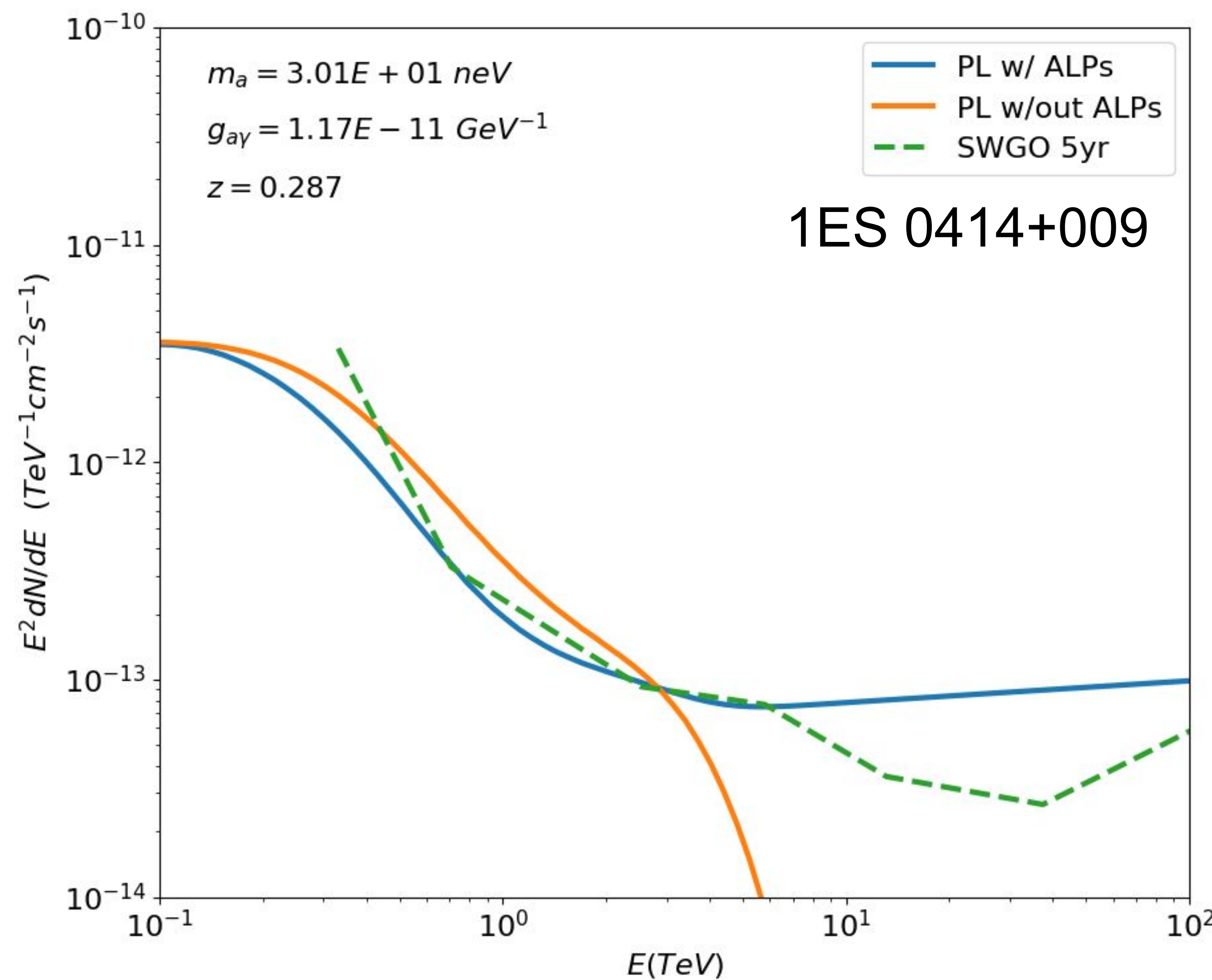


Figure 1: Comparison of 1ES 0414+009 spectrum with and without Axion Like Particle creation at the source. SWGO is expected to be sensitive to the high-energy ALP tail in this spectrum after 5 yrs

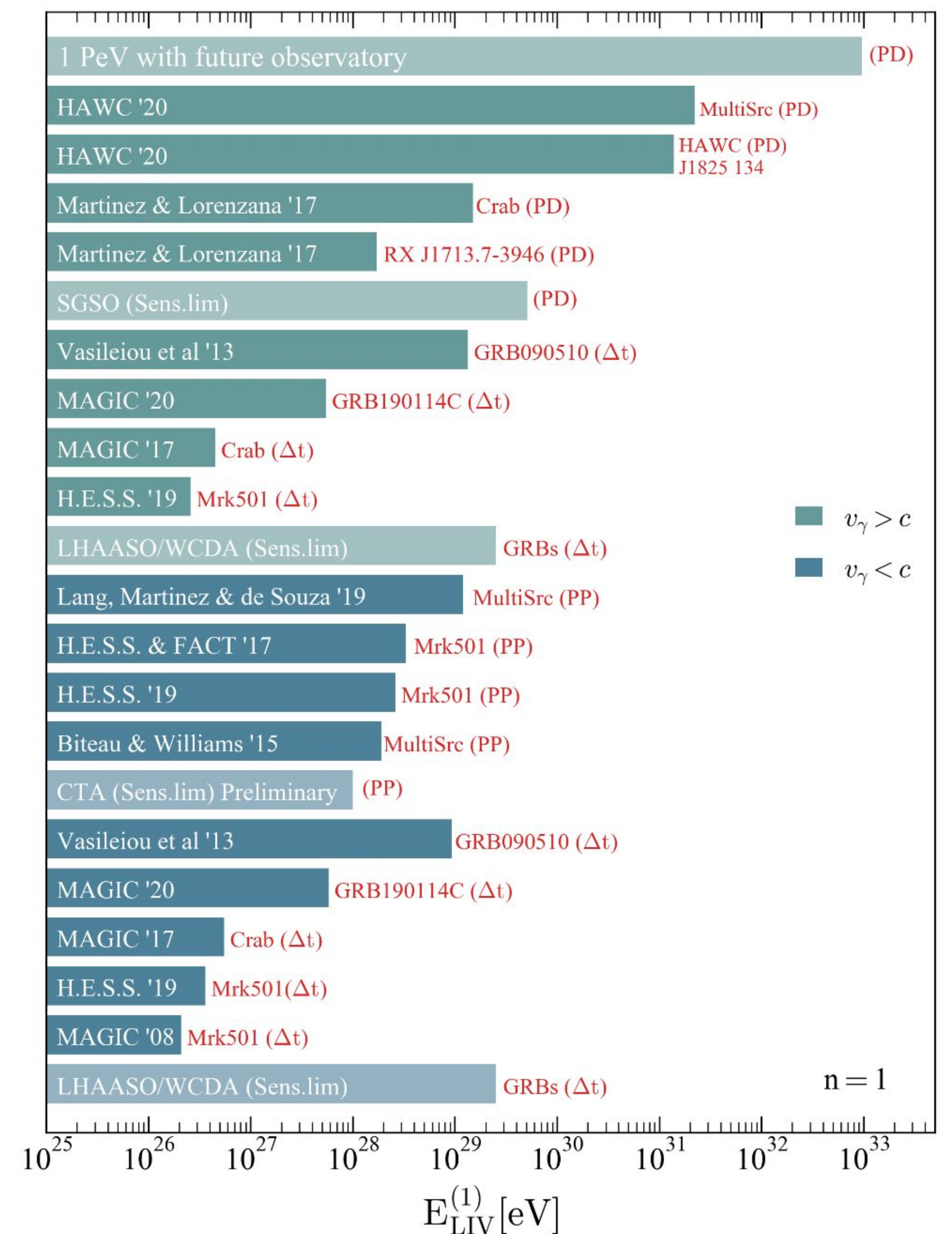


Figure 2: Energy scale of Lorentz Invariance Violation based on the detection of photons at a given energy. A future experiment like SWGO would reach up to PeV gamma-ray energies thus setting world-leading limits

