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Can high altitude horizontal air showers be the source of the anomalous radar echoes observed with the high-power large-aperture Jicamarca radar?

We report on the continuing presence of short duration (t < 10 μ s) radar echoes in our datasets. First reported in 2007 [1], these echoes were observed as part of an effort to identify cosmic ray shower signals in radar data, as per the proposal of Blackett and Lovell [2]. Subsequent experiments such as Mariachi [3] and TARA [4] have reported negative findings, and radar echoes from HDPE [5] point to difficulties in detecting cosmic rays in the lower atmosphere using radars. The Jicamarca high-power large-aperture 50 MHz radar however is able to search for cosmic ray showers at higher altitudes (>20km), where horizontal showers could occur [6]. At these altitudes radar clutter is reduced and collisional damping could be less prominent, favouring radar echoes. In this paper we present data from an experiment run in 2023 (with significant hardware upgrades since 2007), which show signals from a yet unknown physical source that are compatible with a relativistic creation process. We outline the plans to investigate the phenomena further.

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[4] Abbasi, R. U., et al. "First upper limits on the radar cross section of cosmic-ray induced extensive air showers." Astroparticle Physics 87 (2017): 1-17.

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