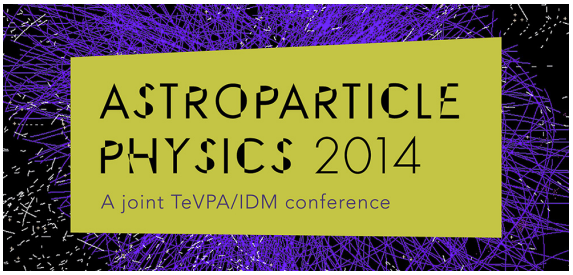

Contribution ID: **177** Type: **Presentation**

Gamma-ray Observations of Galaxy Clusters

Monday, June 23, 2014 4:30 PM (20 minutes)

Galaxy clusters are unique environments to study cosmic-ray acceleration. In comparison to Galactic accelerators, large-scale structure formation shocks associated with merger events and accretion have lower Mach numbers and occur in high-temperature weakly magnetized plasma. Leptonic cosmic rays in clusters are well established observationally through studies of Mpc-scale diffuse radio halos and relics. However, firm evidence for hadronic cosmic rays via detections of diffuse gamma-ray emission has been lacking, even after deep searches with air-Cherenkov telescopes and more than five years of the *Fermi*-LAT survey. The gamma-ray non-detections are notable because cosmic-ray nuclei accelerated in large-scale shocks, injected by AGN, and escaping from cluster galaxies accumulate in the intracluster medium over Gyr timescales and must produce high-energy emission at some level. This integrated non-thermal history of cluster formation encoded in hadronic populations cannot be readily deduced from the shorter-lived leptonic populations alone. I will review current constraints from gamma-ray observations, discuss the implications for cosmic rays and magnetic fields, and consider future observations in gamma rays and other wavebands that may elucidate the role of non-thermal processes in clusters.

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Session Classification: Gamma-Ray Astrophysics

Track Classification: Gamma-Ray Astrophysics