Detection of virial shocks in Fermi-LAT galaxy clusters

Thursday 30 August 2018 14:40 (15 minutes)

Galaxy clusters are thought to grow by accreting mass through large scale, strong yet elusive, virial shocks. These collisionless shocks are thought to accelerate relativistic electrons, generating a spectrally-flat leptonic virial ring. However, with the exception of a VERITAS signal from the Coma cluster, attempts to detect virial rings have all failed. By stacking and rescaling Fermi-LAT data at 1-100GeV for the 112 most massive, high latitude, extended clusters we identify (at the 5.9 sigma confidence level) a bright, spectrally flat gamma-ray ring at the expected radius. This indicates that $\sim 0.6\%$ (with an uncertainty factor ~ 2) of the thermal energy is deposited in relativistic electrons over a Hubble time. This detection is confirmed using two multi messenger analyses of individual clusters:

(1) A combined VERITAS (~220GeV), LAT and ROSAT R1 (~0.2keV) elliptical signal in Coma.

(2) Planck SZ pressure near the virial radius, coincident with a LAT gamma-ray excess in Coma, A2319, and A2142.

This results validate the shock paradigm, calibrate its parameters, and indicate that such shocks significantly contribute to the diffuse extragalactic gamma-ray and radio backgrounds.

Primary author: Mr REISS, Ido (Ben Gurion University of the Negev)

Co-author: Prof. KESHET, Uri (Ben Gurion University of the Negev)

Presenter: Mr REISS, Ido (Ben Gurion University of the Negev)

Session Classification: Extragalactic Science

Track Classification: Extragalactic