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Axion Quark Nugget Annihilation With Baryon Gas Versus Observed Excess Diffuse Ultraviolet Radiation

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A mysterious excess in diffuse far-ultraviolet (FUV) background radiation was observed by the Galaxy Evolution Explorer (GALEX) orbiting telescope with bandwidth 1344–1786 Å. This radiation remains strong even at high galactic latitude where young blue stars, the only known source of UV photons, do not exist. Scattered light from UV sources in the galactic disk is also unable to account for this FUV background.

The novel Axion Quark Nugget (AQN) dark matter model may provide an interpretation for this as-yet-unexplained excess. This model proposes that dark matter consists entirely or partially of macroscopic composite objects of nuclear density. These nuggets exist in matter and antimatter variants, with approximately similar abundances. The antimatter nuggets are composed of a core made of antiquarks in the color superconducting phase, immersed in a positron-sphere which guarantees the near electrical neutrality of the nugget.

Baryons colliding with the antimatter AQNs can eventually annihilate, heating the positron-sphere, which, in turn, emits radiation very similar to Bremsstrahlung. The FUV part of the resulting emission may be responsible for the excess seen by the GALEX telescope in the Milky Way. The main contributors of baryons to this emission are not found in stellar matter, but rather in free protons from the ionized gas in the Warm Hot Intergalactic Medium (WHIM) surrounding the milky way, extending up to the virial radius. To verify this phenomenon, the spectral emissivity of the baryon–(anti)-AQN annihilation, along with the baryon and dark matter number densities, are used to create a sky map of the expected emitted FUV radiation in a Milky Way-like galaxy. This emission sky map is compared with maps of FUV flux magnitude from the GALEX telescope for matches in latitude and longitude.

Understanding the exact source(s) of this FUV excess may bring us a step closer to revealing the exact nature of dark matter.

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