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The cosmic optical background excess and dark matter

Recent studies using New Horizons LORRI images have returned the most precise measurement of the cosmic optical background to date, yielding a flux that exceeds that expected from deep galaxy counts by roughly a factor of two. We investigate whether this excess, detected at ~ 4σ significance, is due to dark matter that decays to a monoenergetic photon with a rest-frame energy in the range 0.5 – 10 eV. We derive the spectral energy distribution from such decays and the contribution to the flux measured by LORRI. The parameter space that explains the measured excess with decays to photons with energies E & 4 eV is unconstrained to date. If the excess arises from dark-matter decay to a photon line, there will be a significant signal in forthcoming line-intensity mapping measurements. Moreover, the ultraviolet instrument aboard New Horizons (which will have better sensitivity and probe a different range of the spectrum) and future studies of very high-energy γ-ray attenuation will also test this hypothesis and expand the search for dark matter to a wider range of frequencies.

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