

THE NEAR INFRARED BACKGROUND II: FROM REIONIZATION TO THE PRESENT EPOCH

Conference Summary

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SINCE LAST TIME...

- Do we know the origin of the excess background light above the galactic light in near infrared bands yet?

NO

- But new ideas have been proposed since our last meeting
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THE MEAN OBSERVATIONS

- Zodi and faint stars dominate the error budget of the measurement of the absolute intensity of the extra-galactic background light (EBL), but stars are being done better
 - After careful foreground removal, the EBL above the galactic light (“EBL excess”) still seen
 - How do we make progress on understanding Zodi?
 - Use old DIRBE data to make new Zodi model? (Arendt)
 - Use Fraunhofer lines (CIBER results just around the corner)
 - May ultimately need to get outside the asteroid belt or out of the plane. Specialized mission or piggyback on a planetary mission?
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THE MEAN OBSERVATIONS CONSENSUS 1

- Could **all** of the EBL excess come from zodiacal light?
 - **Not expected, but not proven impossible.**
 - The current Zodi models (Kelsall or Wright) need to be inaccurate at the level of tens of percent, but there is no evidence for it
 - Rick Arendt: “Maybe it [that the current models are inaccurate at tens of percent] is not impossible, but I do not know how to do it. I have not tried very hard.”
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*defined by the optical depth to e-e+ production being unity

GAMMA-RAYS: CONSENSUS 2.1

- Gamma-ray constraints has come a long way since the last meeting
- Wealth of new data from Fermi and Cherenkov telescopes
- Fermi detected the gamma-ray horizon* due to attenuation of GeV photons ($E < \sim 100$ GeV) by EBL in the rest-frame optical and UV bands
- More consistent with the direct measurements of EBL in optical by Pioneer (Matsuoka et al.) than with the previous measurements by Bernstein et al.
- The Fermi data constrain EBL in the optical and UV bands, but do not constrain EBL in the near-infrared bands ...yet

GAMMA-RAYS: CONSENSUS 2.2

- Cherenkov telescopes (MAGIC, HESS, VERITAS) detected the gamma-ray horizon due to attenuation of TeV photons by EBL in the rest-frame near infrared bands
- These data do constrain EBL in the near-infrared bands, but the constraints are subject to the uncertain contribution from secondary gamma-rays
- However, blazars at low redshifts ($z < \sim 0.15$) are not subject to this uncertainty, and thus can be used to infer the true levels of EBL in the near-infrared bands at low redshifts
- We also need a better understanding of the physics of blazars based on the multi-wavelength data and better modelling of high-energy processes

GAMMA-RAYS: CONSENSUS 2.3

- What else can we use to probe EBL in the near infrared bands?
 - Variability of TeV photons from blazars at high redshift ($z > \sim 0.15$)
 - 0.1 to 1 TeV gamma-rays coincident with Gamma-ray bursts (GRBs) at high redshifts
- If seen, it would be difficult to explain the EBL excess above the integrated galactic counts as the extra-galactic origin
- The current instruments (MAGIC, HESS, VERITAS) lack photon statistics at TeV to test variability of high-z blazars. The highest energy gamma-rays from GRBs detected so far are in tens of GeV. Need CTA

FLUCTUATIONS: CONSENSUS 3

- Does most of the source-subtracted NIRB come from the epoch of reionization ($z > 6$)?
 - The detected fluctuations appear too large to be compatible with $z > 6$ galaxies
 - Would need something “special” and more unconventional
 - Direct collapse black holes can get this amplitude from $z > 6$ at certain NIR wavelengths, but the current model cannot explain fluctuations at all wavelengths simultaneously
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CROSS-CORRELATIONS

- New since our last meeting!
- Cross correlations:
 - CIB-CXB – insight into high energy processes. 99% CL evidence for the large-scale correlation, with $\sim 20\%$ cross-correlation coefficient. Black holes at high redshifts?
 - Far-IR background – dust
 - CIB-21cm cross correlation – neutral hydrogen & reionization history
 - CIB and high-z galaxies
 - CIB and CMB

CROSS-CORRELATIONS: CONSENSUS 4

- Cross-correlation is the best way to go for...
 - ...understanding the origins of EBL fluctuations in the near infrared bands
 - ...to constrain the high- z signal that we know is there
 - Preparations already underway and results may come before the NIRBIII meeting
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