

Olbers' Reality: An Addendum

Speculative thoughts of Auden S. Howard

Abstract

This addendum delves into the observational experience of a planet situated in an ultra-dense stellar region, specifically the galactic centre, expanding upon the concepts presented in “Olbers's Inverse: The All-Lit Problem.”

Hypothetical Scenario

Imagine a planetary system identical in all its functionalities to our Solar System, with an Earth-like planet orbiting a Sun-like star, only located in the galactic centre. I aim to explore how the night sky on this planet compares to that on Earth, focusing on the degree of increased brightness due to the surrounding stellar density.

Stellar Density Comparison

- **Solar Neighbourhood:** Stellar density is approximately 0.14 stars per cubic parsec¹.
- **Galactic Centre:** Stellar densities reach up to 10^6 stars per cubic parsec².

This results in a stellar density increase by a factor of about 7 million.

Night Sky Brightness Estimation

The cumulative luminosity from nearby stars significantly enhances the night sky's brightness.

- **Earth's Night Sky Brightness:** Approximately 22 mag/arcsec^2 .³
- **Galactic Centre Sky Brightness:**
 - Using the relation: $\Delta m = -2.5 \log_{10} \left(\frac{n_{GC}}{n_{SN}} \right)$, where n_{GC} and n_{SN} are the stellar density of the galactic centre and solar neighbourhood respectively.
 - $\Delta m = -2.5 \log_{10}(7 \times 10^6) \approx -17.1$
 - $\therefore m_{GC} = m_{Earth} + \Delta m \approx 22 - 17.1 = 4.9 \text{ mag/arcsec}^2$

- This brightness is akin to Earth's twilight conditions.

Visual Appearance

- **Abundance of Stars:** Millions more stars visible to the naked eye.
- **Brighter Sky Background:** A luminous backdrop reducing contrast between individual stars and the sky.
- **Dominant Galactic Features:** The Milky Way's central bulge appears more prominently, filling a significant portion of the sky.
- **Minimal Darkness:** The concept of "night" blurs, with the sky never reaching true darkness.

Perceptibility

An observer would undeniably notice the increased brightness. The perpetual twilight affects natural cycles, potentially influencing any native life forms' behaviours and physiological processes.

Conclusion

From the vantage point of a planet in the galactic centre, the night sky embodies the essence of Olbers' Inverse—a sky teeming with starlight, leaving little room for darkness. This stark contrast to Earth's night sky underscores the profound impact of stellar density on celestial observations.

References

1. Reid, M. J., & Gizis, J. E. (1997). "The Stellar Density in the Solar Neighborhood." *The Astronomical Journal*, 113(1), 224.
2. Genzel, R., Eisenhauer, F., & Gillessen, S. (2010). "The Galactic Center massive black hole and nuclear star cluster." *Reviews of Modern Physics*, 82(4), 3121.