

Probing the Dark Ages and Cosmic Dawn: Toward a Roadmap for NASA Astrophysics

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The *New Worlds, New Horizons* Decadal Survey identifies “Cosmic Dawn” as one of the three science objectives for this decade. The **Epoch of Reionization** is a science frontier discovery area, and “**What were the first objects to light up the Universe and when did they do it?**” is a science frontier question in the Origins theme.

The Astrophysics Division of NASA recently constituted an Astrophysics Roadmap Committee, charged with the task of constructing a compelling, 30-year vision for astrophysics. On behalf of the Lunar University Network for Astrophysics Research (LUNAR), part of the NASA Lunar Science Institute, we presented to the Astrophysics Roadmap Committee the rationale for including neutral hydrogen observations during the Dark Ages and Cosmic Dawn as part of the NASA Astrophysics Roadmap. This rationale is two-fold. First, the motivating science is compelling, as recognized by the *NWNH* Decadal Survey, and offers the promise of tracking the evolution of the Universe during times when there may be no other means present. Second, space-based observations will ultimately be required as the H I 21 cm line is redshifted to wavelengths at which ionospheric opacity is significant, e.g., at $z = 20$, the transition is redshifted to $\lambda 4\text{m}$ (67 MHz) and, at $z = 70$, to $\lambda 15\text{m}$ (20 MHz).

We review the range of cosmic time that can be probed by hydrogen-based measurements, with a particular focus on those that will require space-based measurements, the measurement approaches available, and the current status of the NASA Astrophysics Roadmap itself.

Part of this research was carried out at the Jet Propulsion Laboratory, California Institute of Technology, under a contract with the National Aeronautics and Space Administration. The LUNAR consortium is funded by the NASA Lunar Science Institute to investigate concepts for astrophysical observatories on the Moon.