The SPHEREx All-Sky Infrared Spectral Survey and UVEX

Spectro-Photometer for the History of the Universe, Epoch of Reionization, and Ices Explorer

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http://spherex.caltech.edu

SPHEREx Team

SPHEREX DESIGNED TO ADDRESS THE MOST IMPORTANT QUESTIONS IN ASTROPHYSICS

- How did the Universe begin?
  - ➡ Probe the physics of the young inflationary Universe through the 3D spatial distribution of galaxies

- How did Galaxies begin?
  - ➡ Study the cosmic history of light production through near-infrared background fluctuations

- What are the Conditions for Life Outside the Solar System?
  - ➡ Survey the Milky Way for water ices and other biogenic molecules

SPHEREx probes the origin of the Universe, galaxies, and life

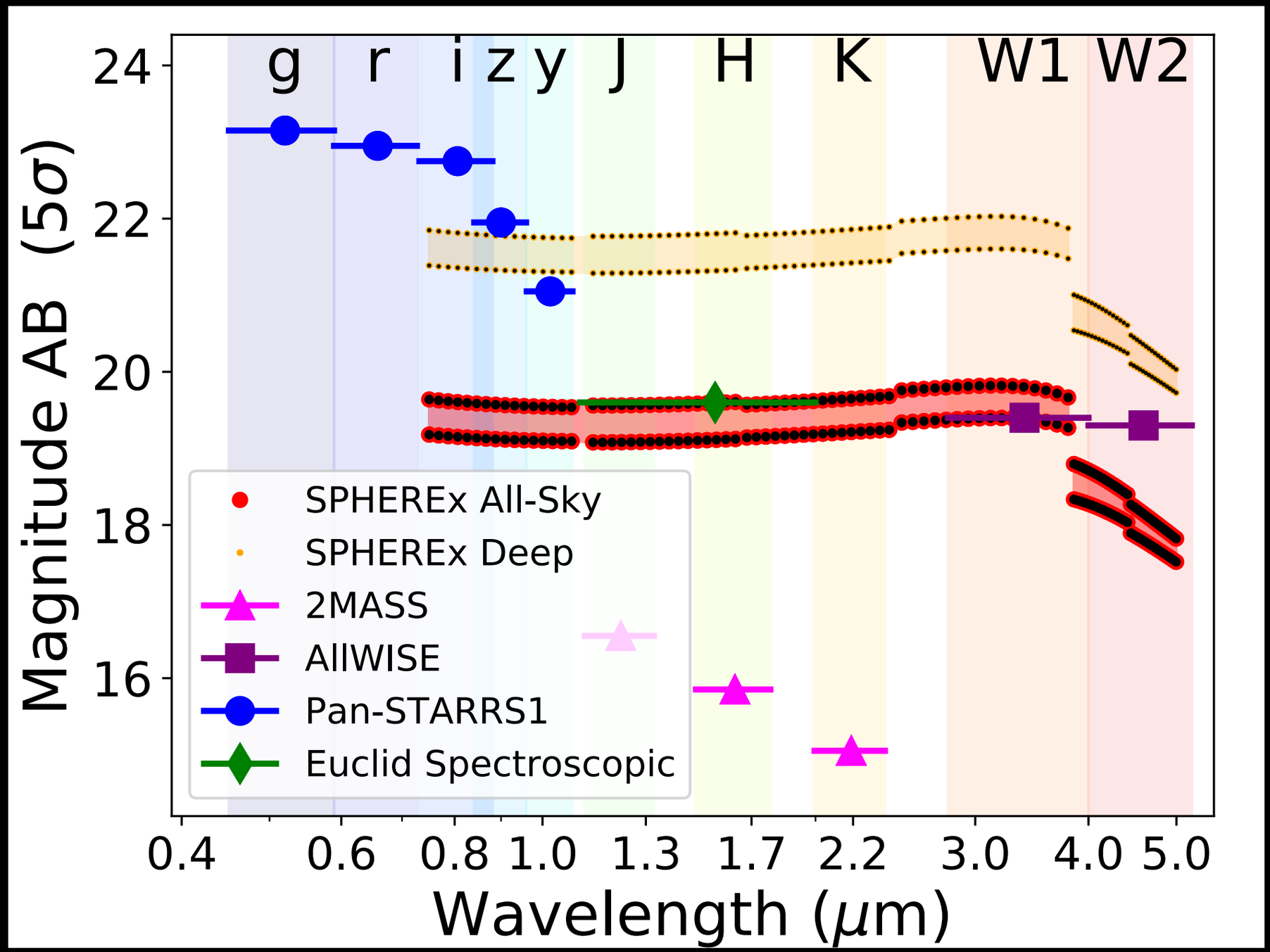
We will do so by constructing the first all-sky near-infrared spectral survey

SPHEREX: AN ALL-SKY SPECTRAL SURVEY

SPHEREx Dataset:

- For every 6.2” pixel over the entire sky:
  - ➡ R=35-41 spectra spanning 0.75 μm < λ < 3.82 μm
  - ➡ R=110-130 spectra spanning 3.82 μm < λ < 5.0 μm
- ≃ all-sky survey with 102 fine photometric bands

SPHEREX SURVEY DEPTH

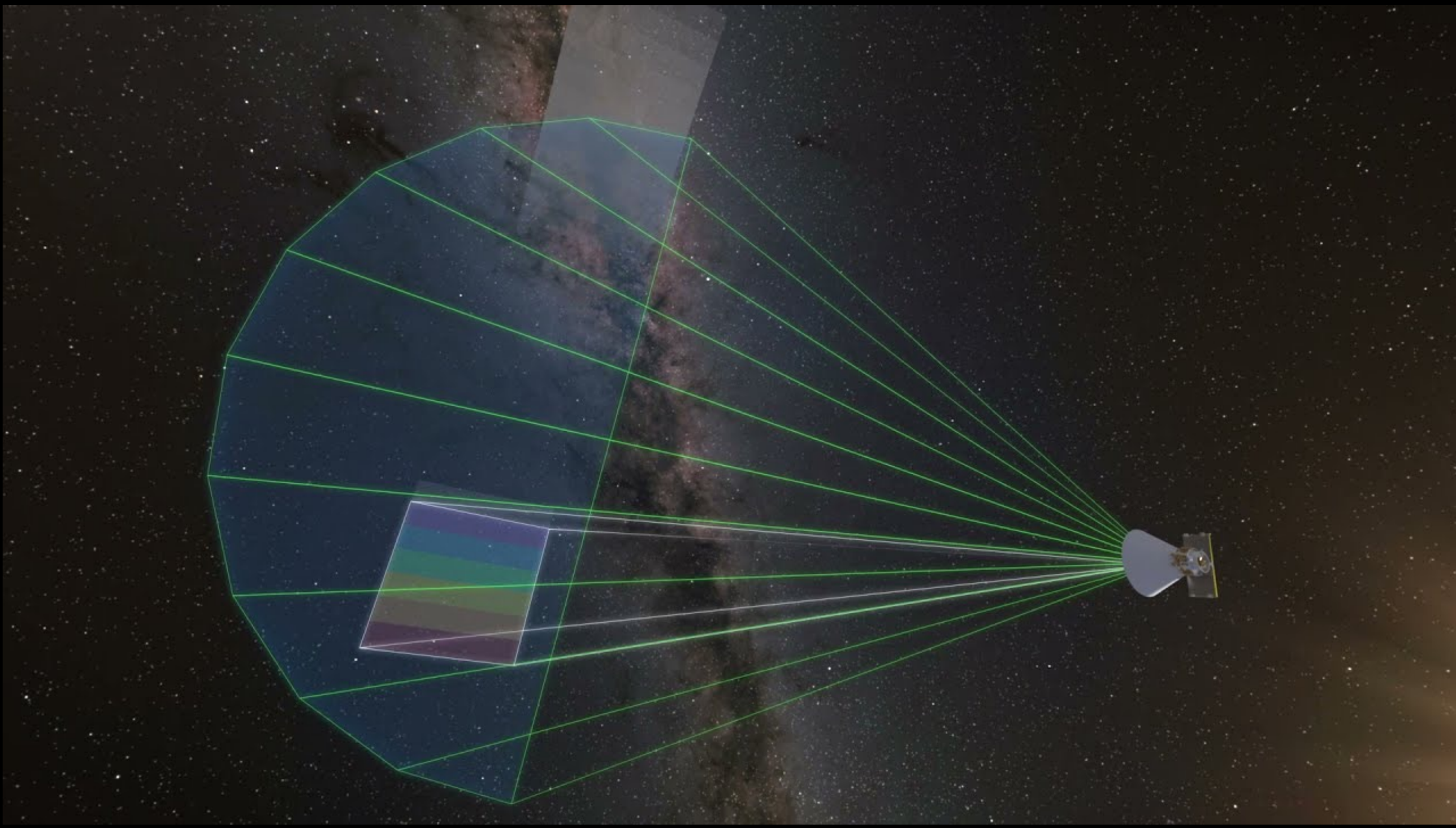


Deep survey

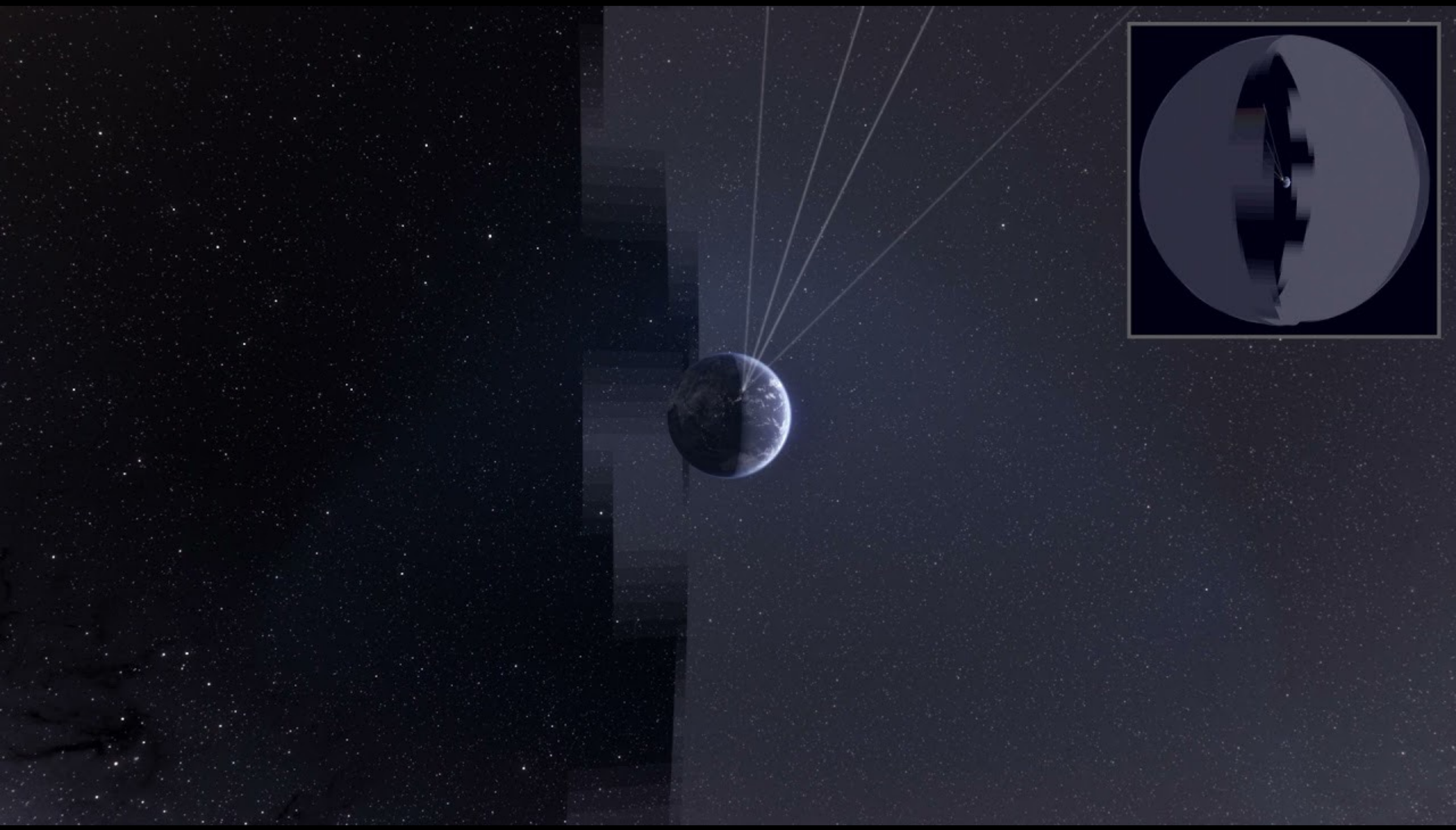
All-sky survey

Plot generated in 2018 but actual performances in the lab consistent

PRE-PROGRAMED SCANNING STRATEGY



PRE-PROGRAMED SCANNING STRATEGY

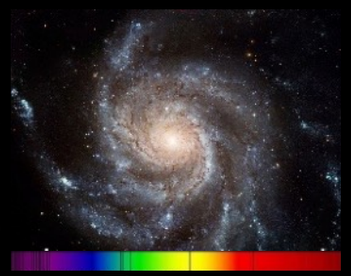


SPHEREX PROVIDES A RICH ALL-SKY SPECTRAL ARCHIVE

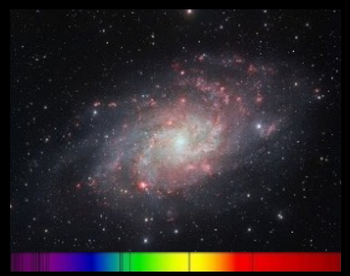
Galaxies

Detected
> 1 billion

Med. Accuracy z's
> 100 million



High Accuracy z's
10 million



Clusters
25,000

Stars

Main Seq. Spectra
> 100 million

Dust-forming
10,000

Brown Dwarfs
> 400

Cataclysms
> 1,000

Other

Quasars
> 1 million

Quasars z >7
3 – 300?

Asteroid Spectra
10,000

Galactic Line Maps
PAH, HI, H_2

➡ All-Sky surveys demonstrated high scientific returns with lasting data legacy used across astronomy (COBE, IRAS, GALEX, WMAP, Planck, WISE)

➡ Many exciting discoveries will come from the community

OD++16,18

SYNERGIES WITH UVEX

- SPHEREx and UVEX both offer all-sky coverage at comparable resolution (6.2” vs 2.25”)
  - ➡ It naturally leads to a very wide range of archival work
  - ➡ It is as broad and rich as astrophysics is

- Having the UV component for the 100Ms SPHEREx galaxies will add robustness to the redshift measurements, but also let us measure the star formation, its clustering, and thus the relation between star formation and DM

- Adding in Rubin, we would have a full coverage from UV till NIR for 100Ms of objects with spectral information in the NIR with SPHEREx

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& strong and experienced engineering team @ JPL and Ball Aerospace

Image Credit: Illustris TNG

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