



U.S. EXTREMELY **LARGE**  
**TELESCOPE** PROGRAM

# The US-ELTP: Understanding the Universe

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**Robert Kirshner**

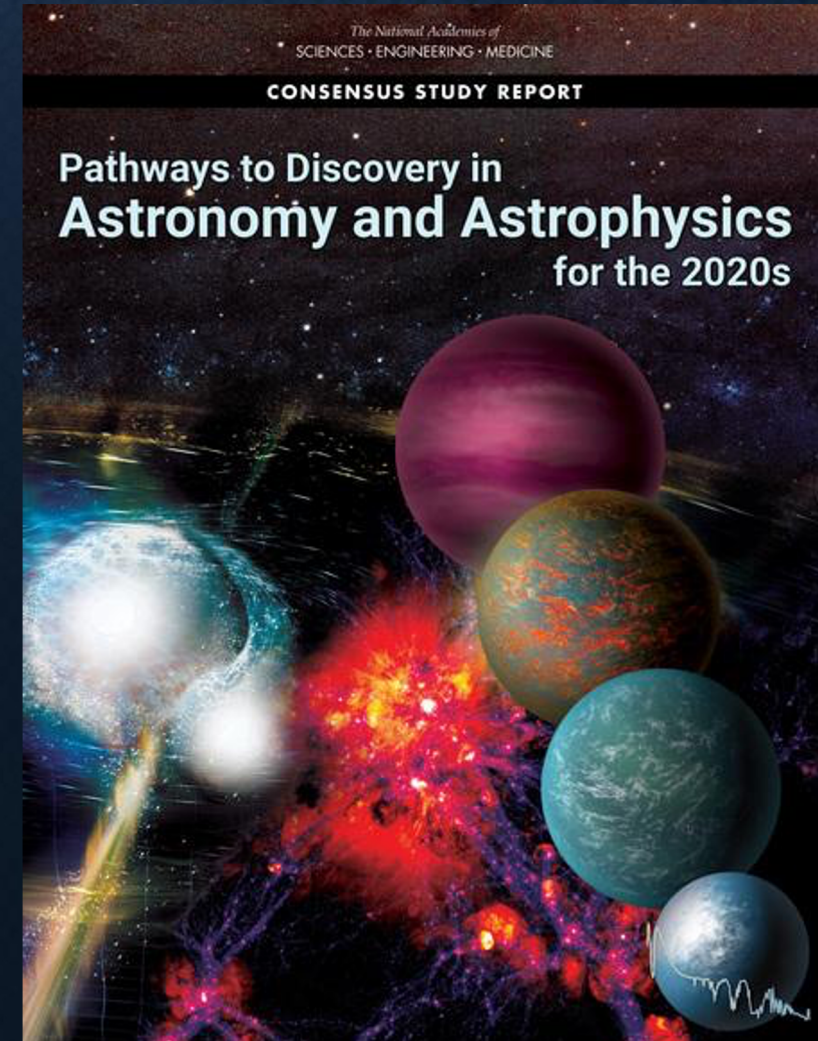
Executive Director, TMT International Observatory



# Top Priority of ASTRO 2020



... the survey's priority for a frontier ground-based observatory is a significant U.S. investment in the Giant Magellan Telescope (GMT) and Thirty Meter Telescope (TMT) projects, ideally as components of a coordinated U.S. Extremely Large Telescope Program (ELT) program



# US-ELTP: Understanding the Universe

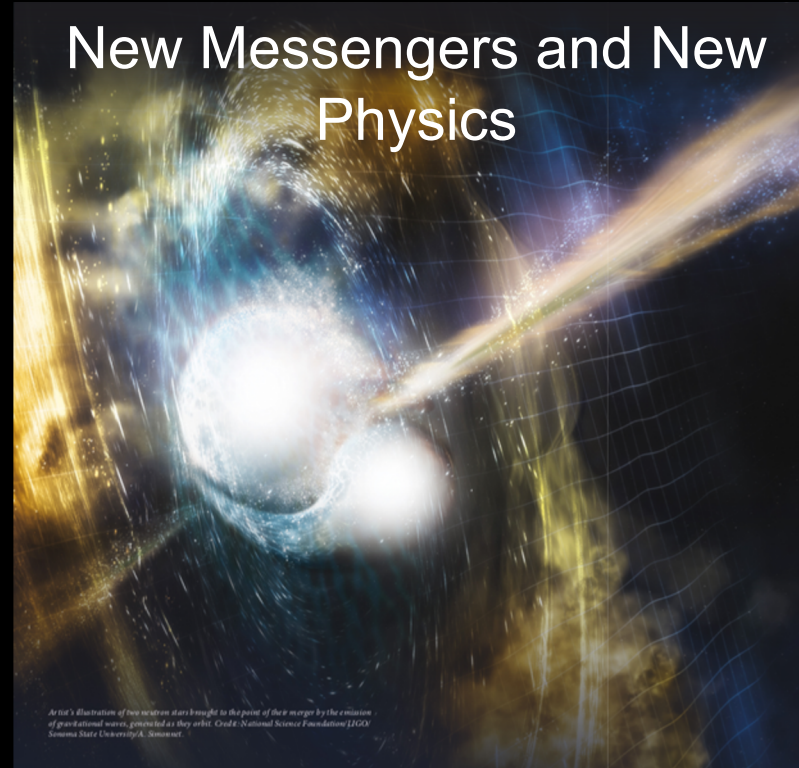


## Worlds and Suns



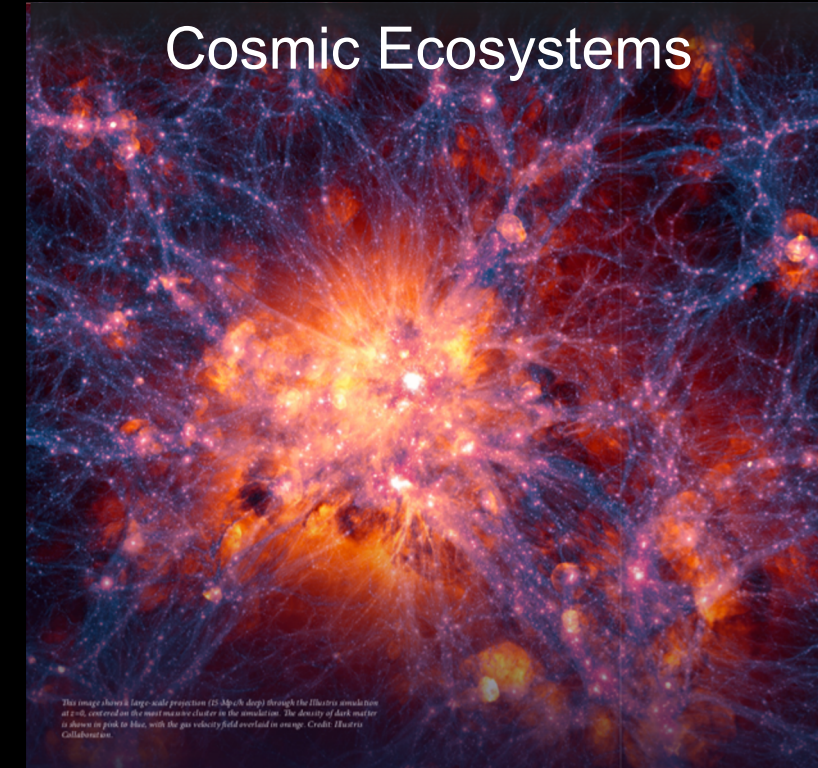
- Find Earth 2.0
- Search for life on other star's planets

## New Messengers and New Physics



- Gravitational wave events & relics
- The composition (dark matter) and physics (dark energy) of the Universe

## Cosmic Ecosystems

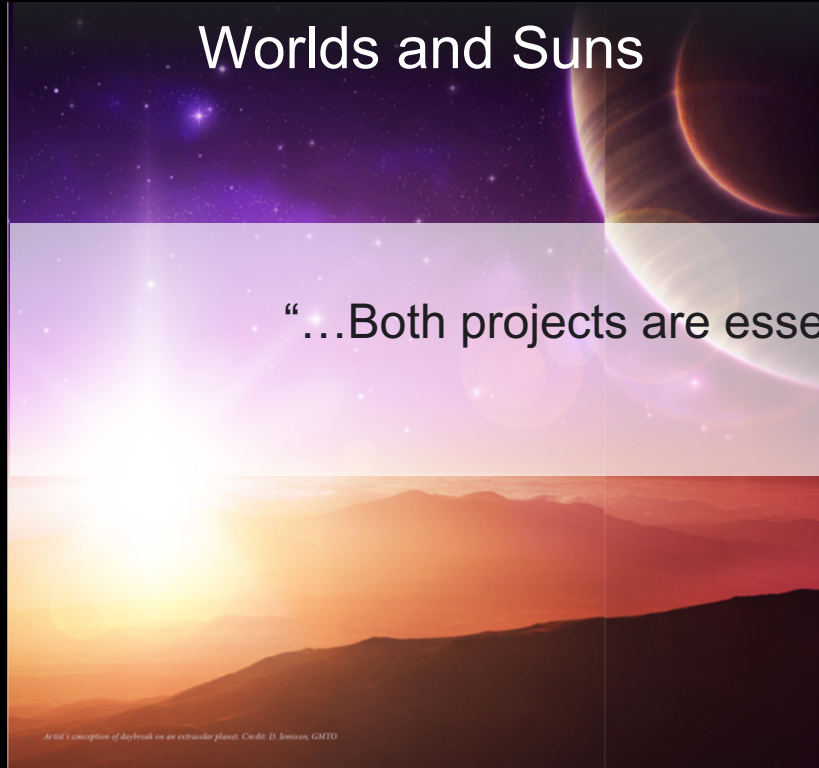


- The physics and chemistry of the first galaxies
- Black holes and galaxy evolution

# US-ELTP: Understanding the Universe



## Worlds and Suns



## New Messengers and New Physics



## Cosmic Ecosystems



“...Both projects are essential for keeping the U.S. community’s global scientific leadership”

— Astro2020

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# US-ELTP: Understanding the universe



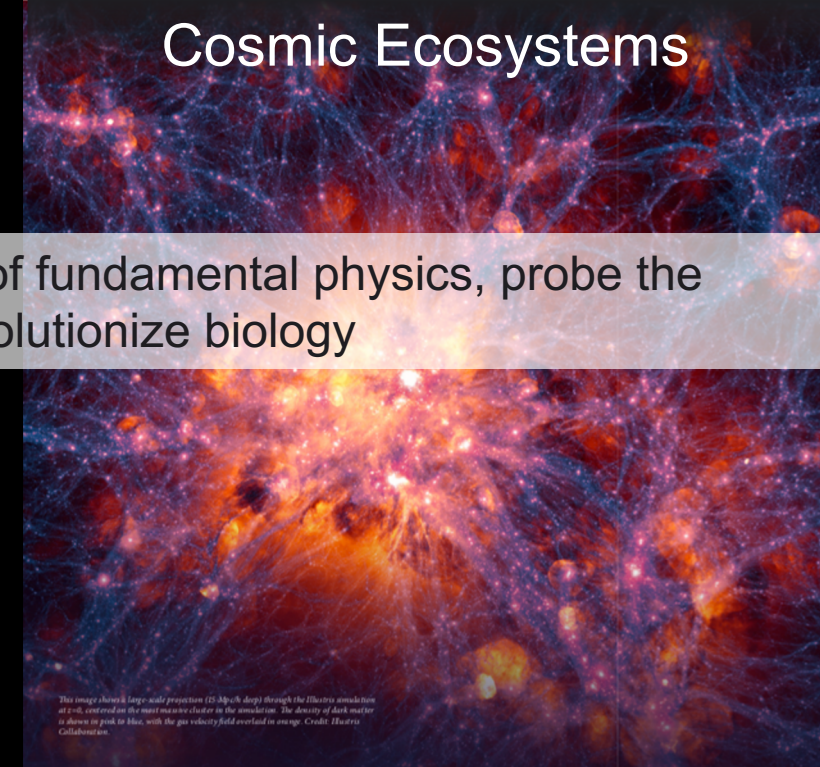
## Worlds and Suns



## New Messengers and New Physics



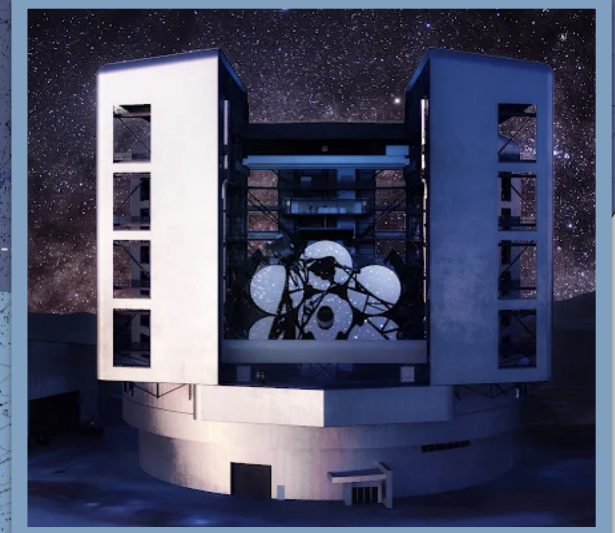
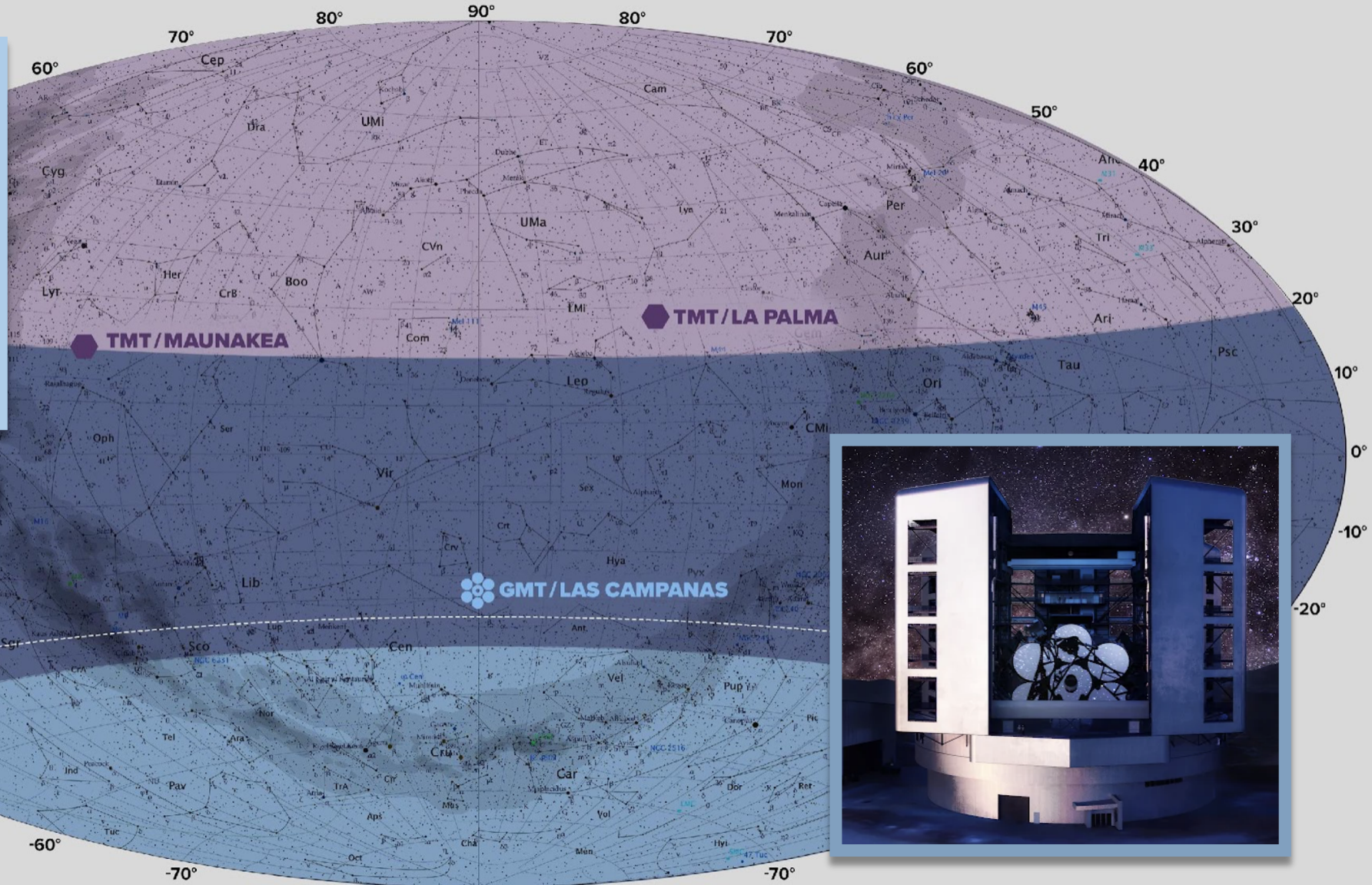
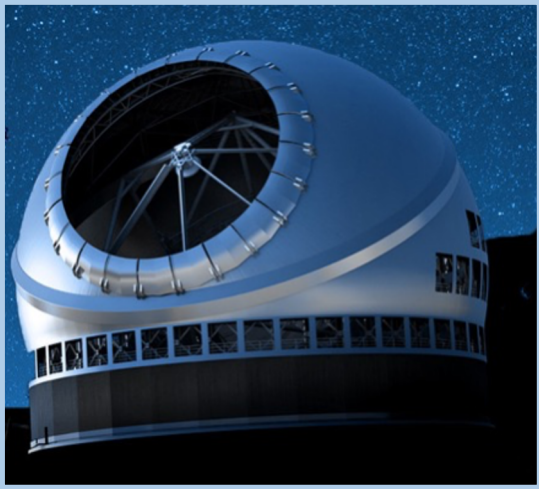
## Cosmic Ecosystems



Not just for astronomy! US-ELT discoveries will address deep questions of fundamental physics, probe the geology and atmospheres of exoplanets, change chemistry and could revolutionize biology

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# Access to the whole Universe for US Astronomers



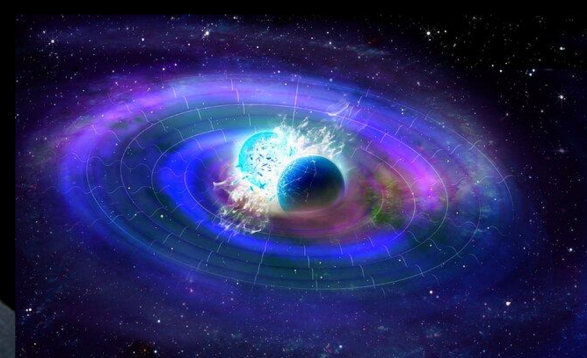
# All-sky coverage for transient events



April 8, 2019 18:18:02 UTC

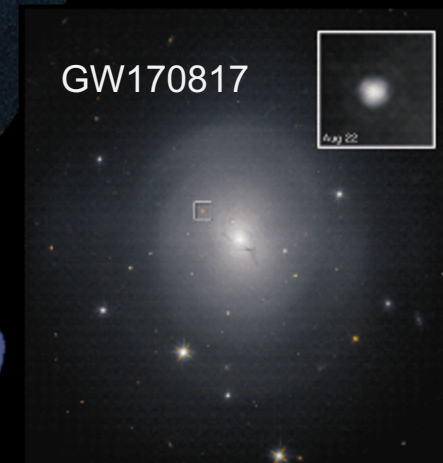
GW190408\_181802

3.52 Gyr ago



*The BEST CANDIDATE might appear in either hemisphere  
No matter where, USELT can study it*

*Optical counterparts of gravitational  
wave events will lead to deeper  
understanding—faint and fleeting*



# US-ELT: How life can change planets

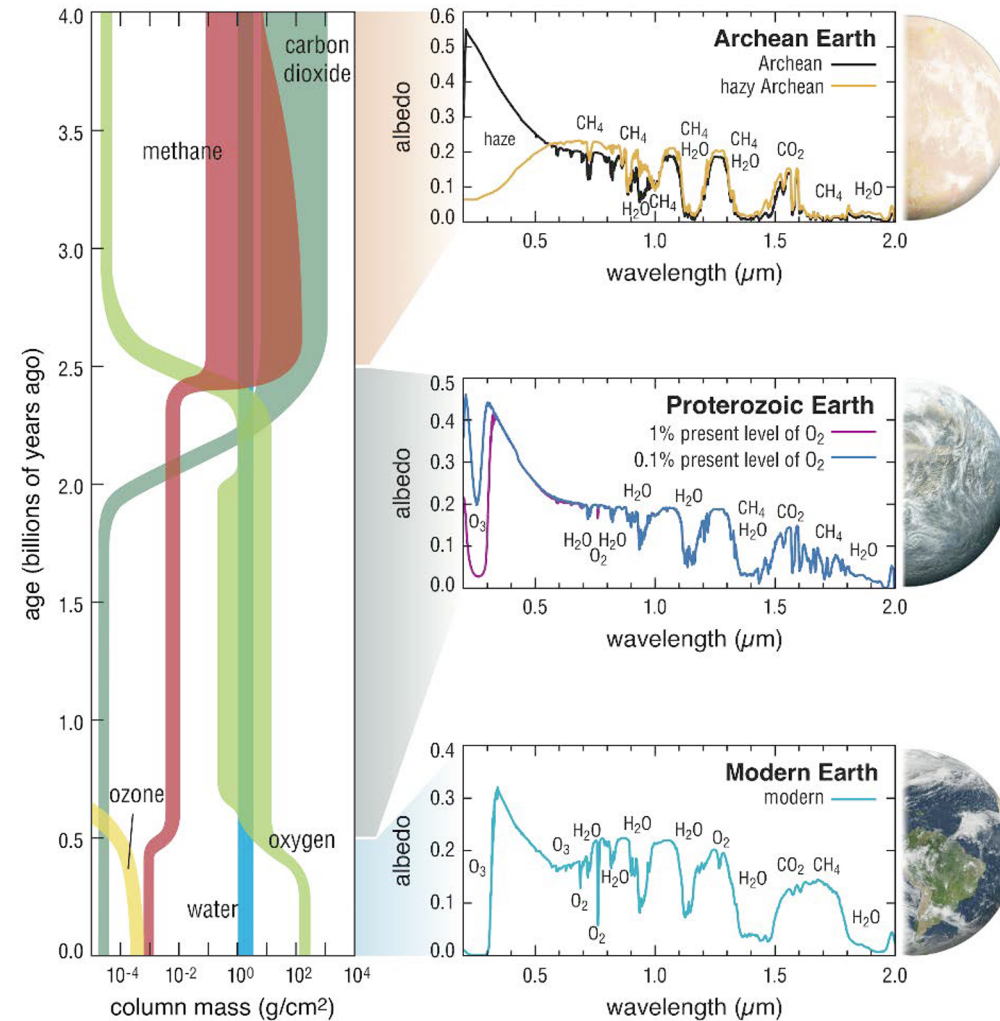


The presence of life has changed the atmosphere of Earth.

Infrared spectra will probe planets around other stars

We'll need ELTs to explore many systems in the slender habitable zones around M-dwarfs

Figure from LUVOIR Report





...a powerful reminder of the scientific payoffs that can result from the combination of persistence and ingenuity, built on the foundation of engineering prowess.

Tom Rosenbaum



<https://noirlab.edu/us-eltp/>

