

# with Science at Eclipses and

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# Scientific efforts enhance public's eclipse appreciation

**The New York Times.**

MONDAY, NOVEMBER 10, 1919.

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## LIGHTS ALL ASKEW IN THE HEAVENS

Men of Science More or Less  
Agog Over Results of Eclipse  
Observations.

### EINSTEIN THEORY TRIUMPHS

Stars Not Where They Seemed  
or Were Calculated to be,  
but Nobody Need Worry.

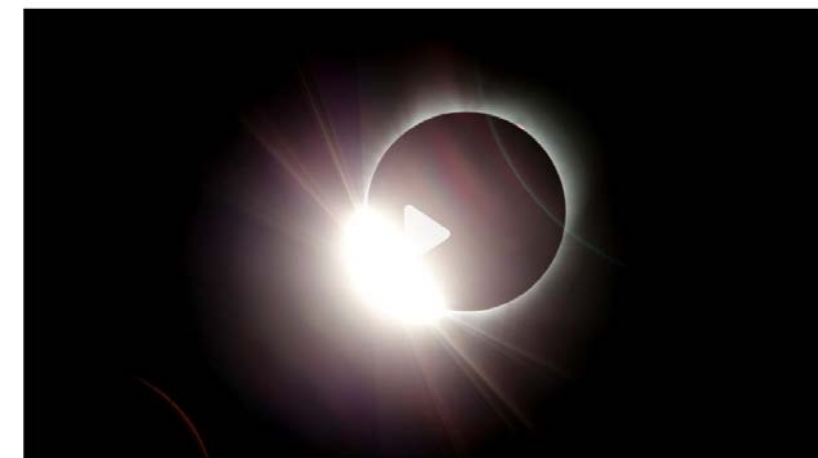
## VIDEO: NASA scientists travel to Exmouth for total eclipse

Posted Mon 17 Apr 2023 at 11:18pm



## What scientists hope to learn from the eclipse

By Ashley Strickland, CNN  
Updated 9:52 PM EDT, Sun August 20, 2017



# (Modern) Unique Opportunities for Science

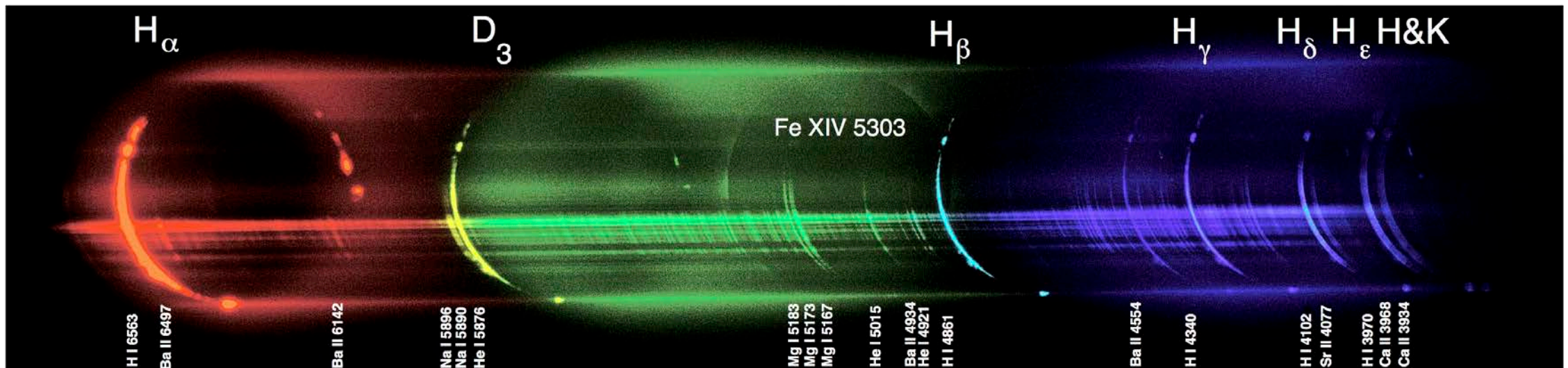
## Observing Advantages

- Low scattered light
- View of inner corona
- High time cadence
- Extended duration (e.g. CATE2024)

## What Can We Measure

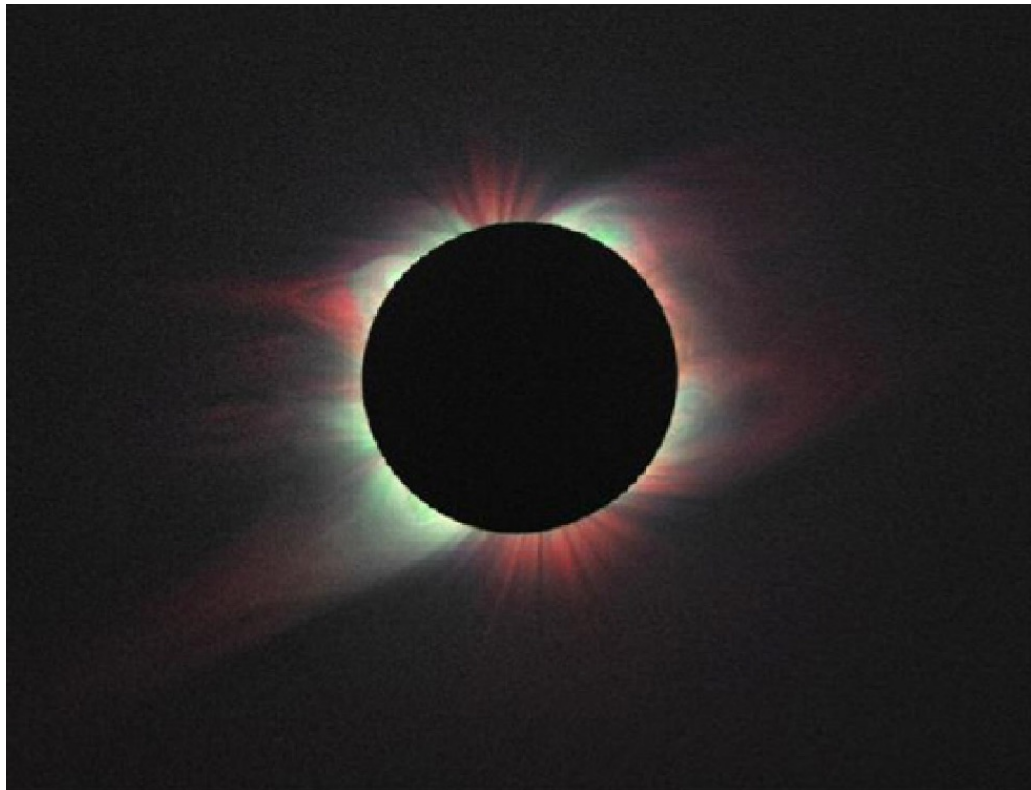
- Temperatures
- Densities
- Magnetic Structures
- Waves or Changes

## Most Powerful Tool - Spectroscopy!



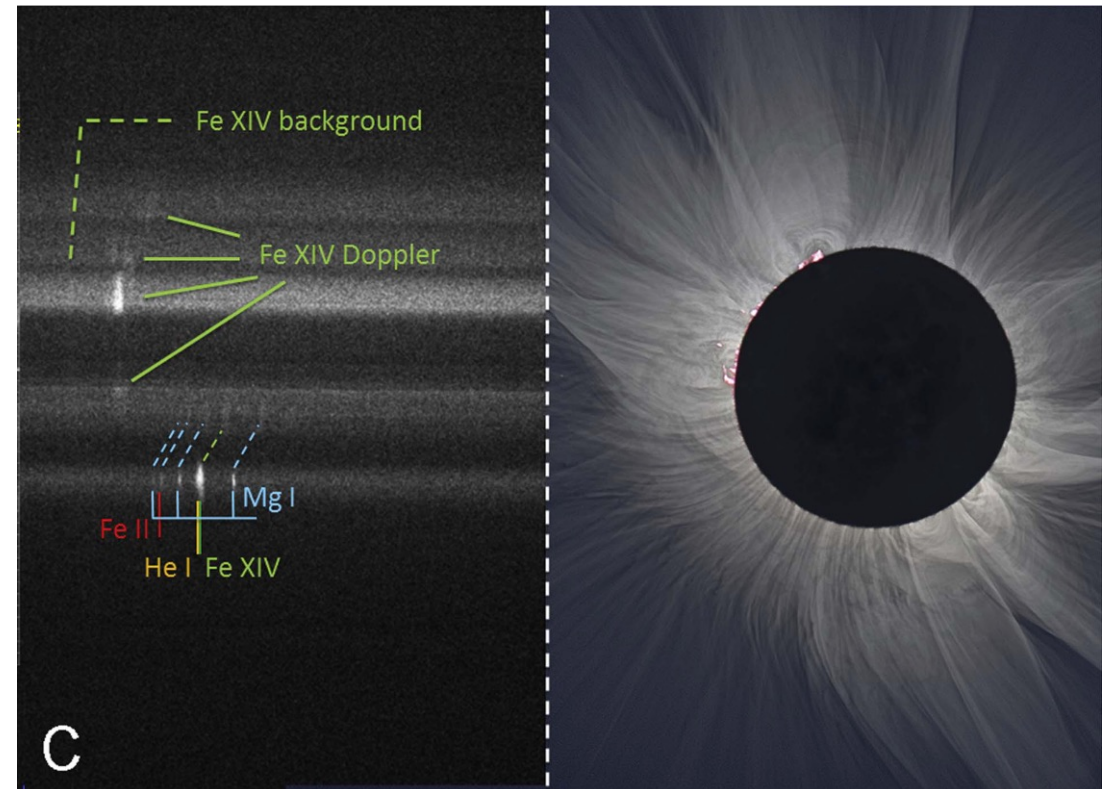
# Different Types of Spectroscopy

Filter Spectroscopy



Habbal et al., 2010, ApJ, **708**

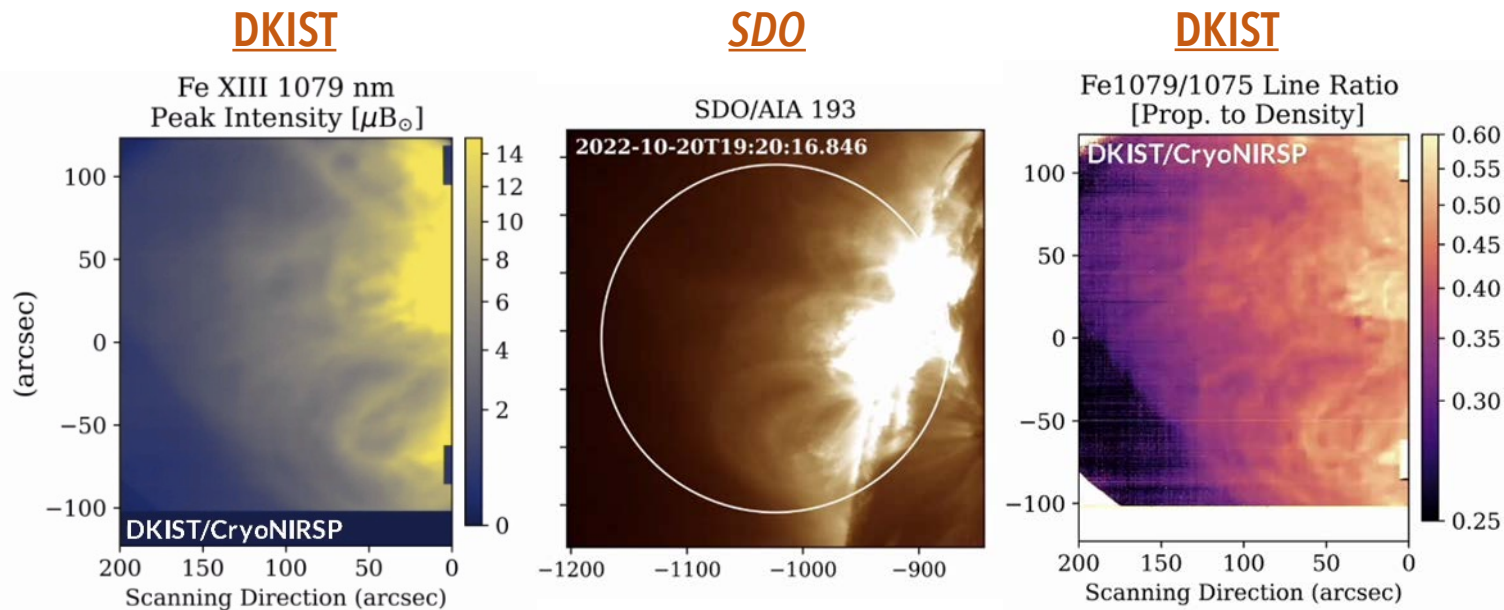
Grating Spectroscopy



Ding and Habbal, 2017, ApJL, **842**

# Spectroscopy outside of Eclipses – DKIST Science with eclipse

- DKIST is a four-meter, off-axis, solar telescope on Haleakāla, Hawai'i
- Can function as a coronagraph – observes the corona outside of eclipses
- Maps densities & temperatures of ions → comparisons with eclipse electron corona
- DKIST can also measure coronal magnetic fields



Daniel K Inouye Solar Telescope



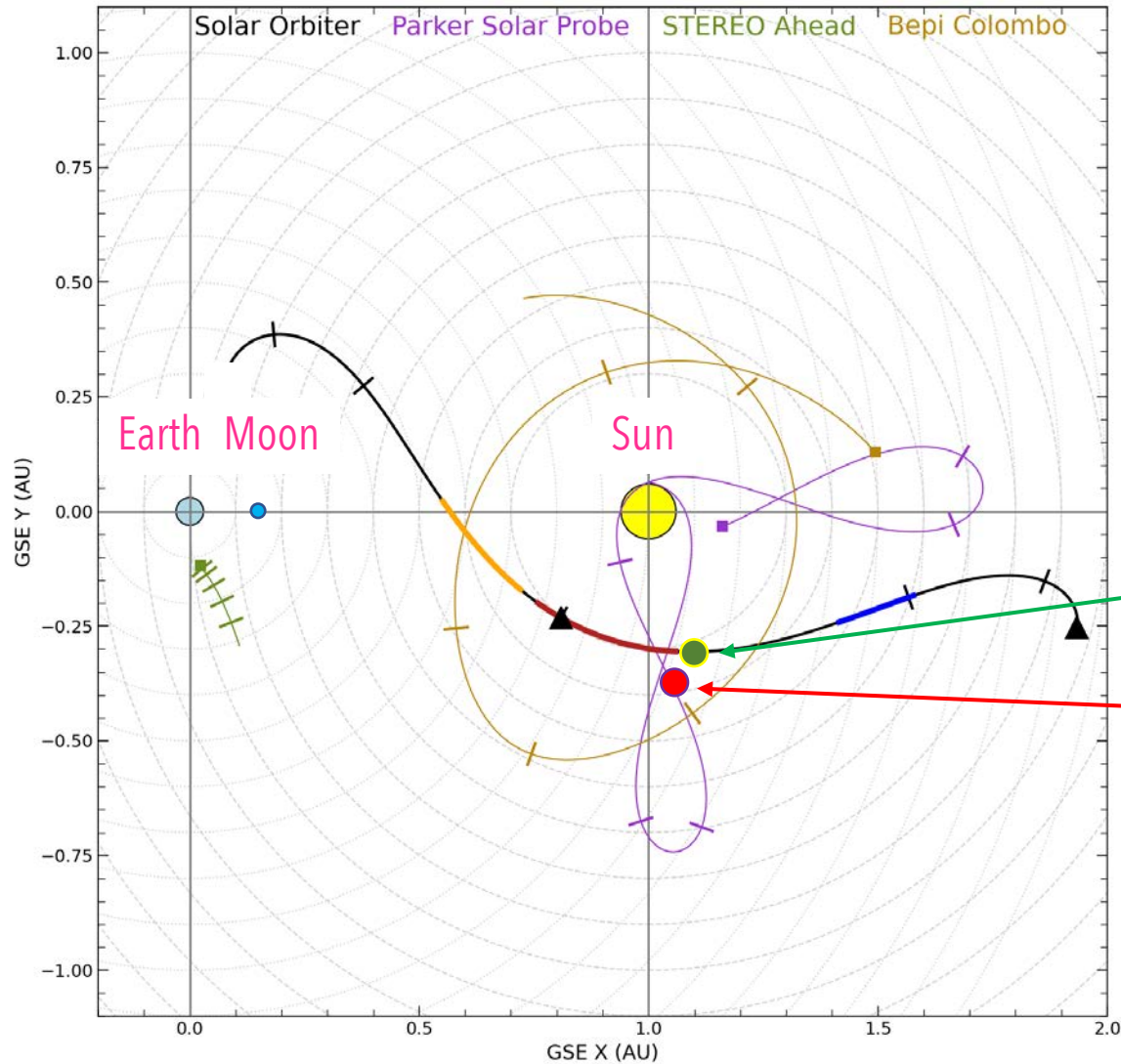
# Non-Eclipsed Observations

Observatories outside of the path of totality can observe the Sun at the same time and derive important, complementary information

## **For 2023 and 2024 eclipses:**

- Solar Dynamics Observatory
- IRIS
- Very Large Array
- Extended Owens Valley SolarArray
- Big Bear Solar Observatory
- Dunn Solar Telescope (NMSU)
- COMP
  
- Solar Orbiter
- Parker Solar Probe     **in quadrature!**

# Spacecraft quadrature



## Scientific driver:

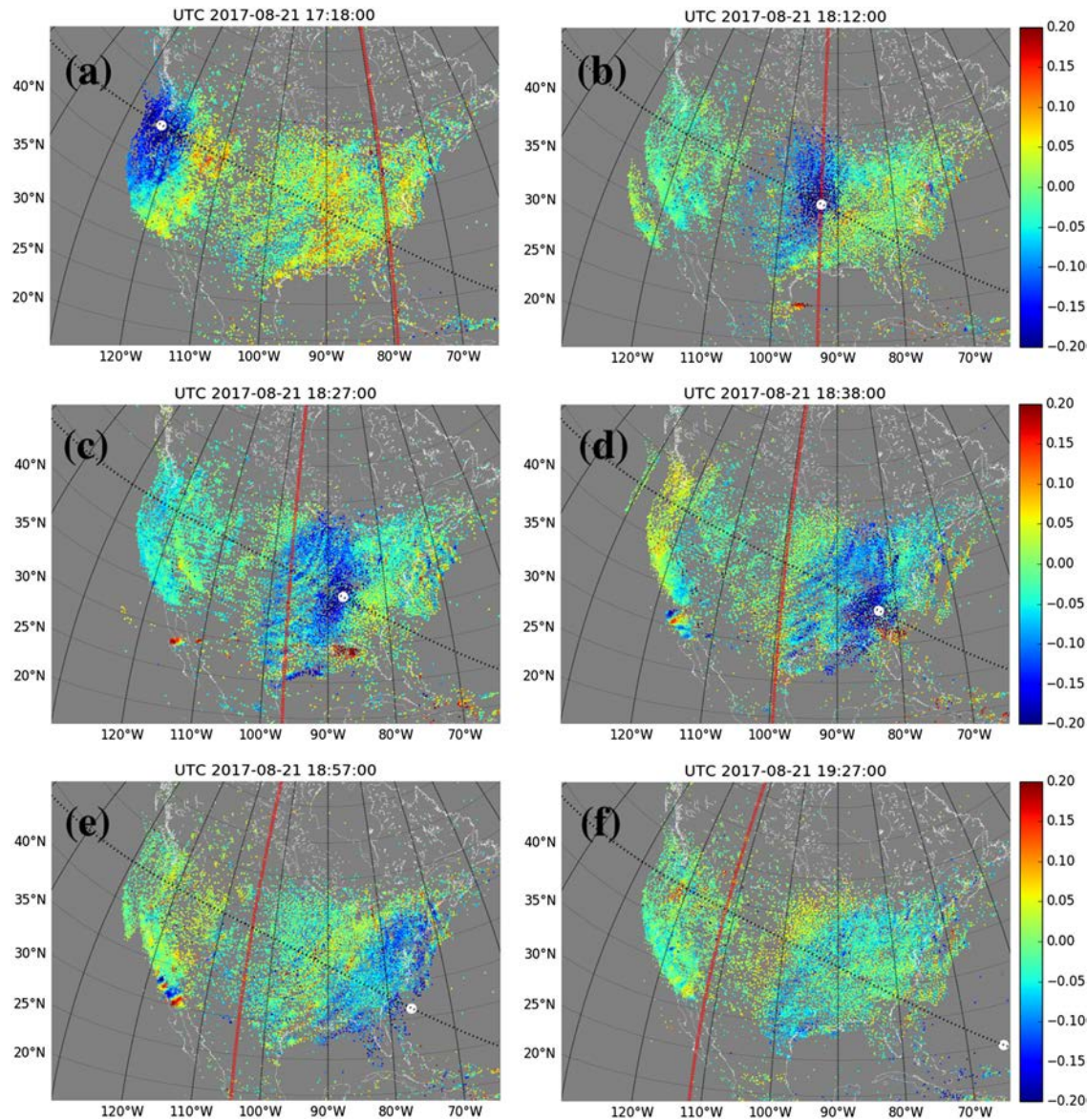
Can measurements in the totality path & DKIST help understand the near-Sun in-situ measurements by PSP and Solar Orbiter?



spacecraft positions on 08 April 2024

# Effects on Earth's Atmosphere

Supersonic passage of shadow (a temperature perturbation) can create ***ionospheric Disturbances***, akin to a bow wave



Zhang et al., 2017