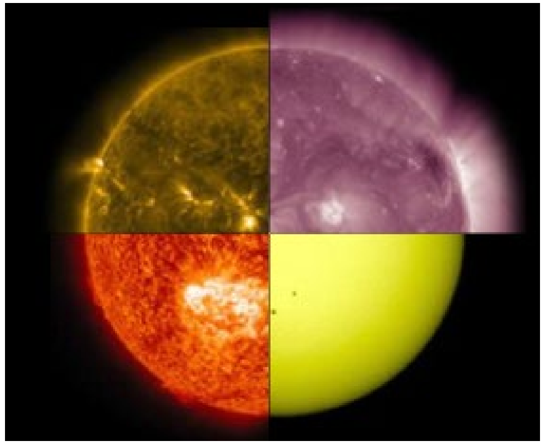
The Small NASA Optical Ultraviolet Telescope (SNOUT): A SmallSat mission concept to connect extreme UV stellar flares to exoplanetary atmospheres

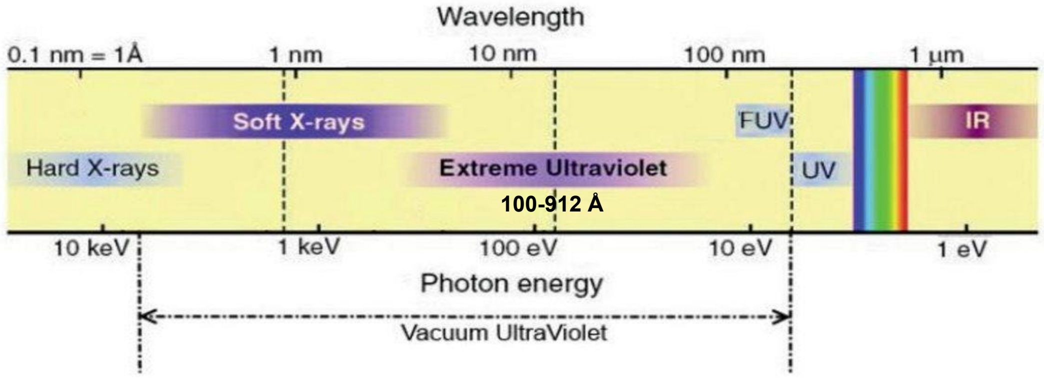
Keri Hoadley (on behalf of the SNOUT team)
PI: Dr. Allison Youngblood, GSFC
keri-hoadley@uiowa.edu

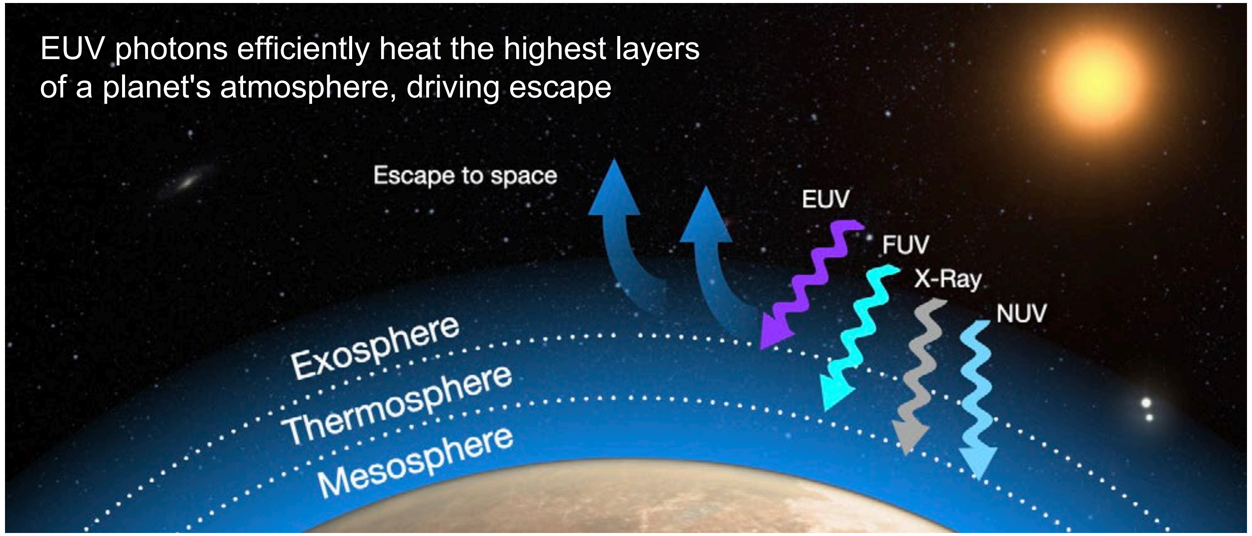


IOWA

Pathways to Habitable Worlds

- How does a planet’s interaction with its host star and planetary system influence its atmospheric properties over all time scales? (Worlds and Suns in Context focus area, Astro2020 Decadal Survey)
- Atmospheres are affected by chemistry, outgassing, and escape
- Escape is a critical process affecting all planets

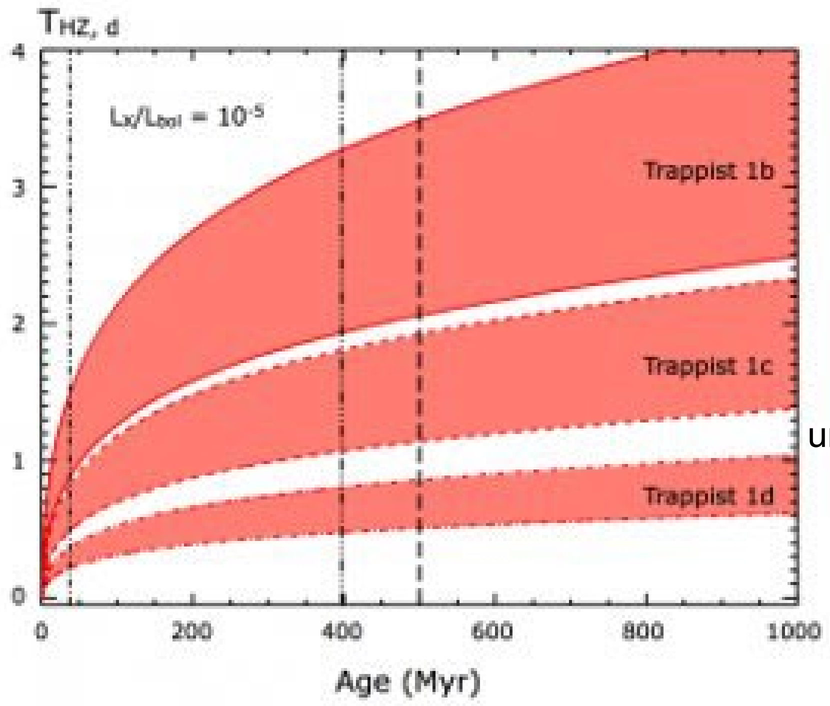




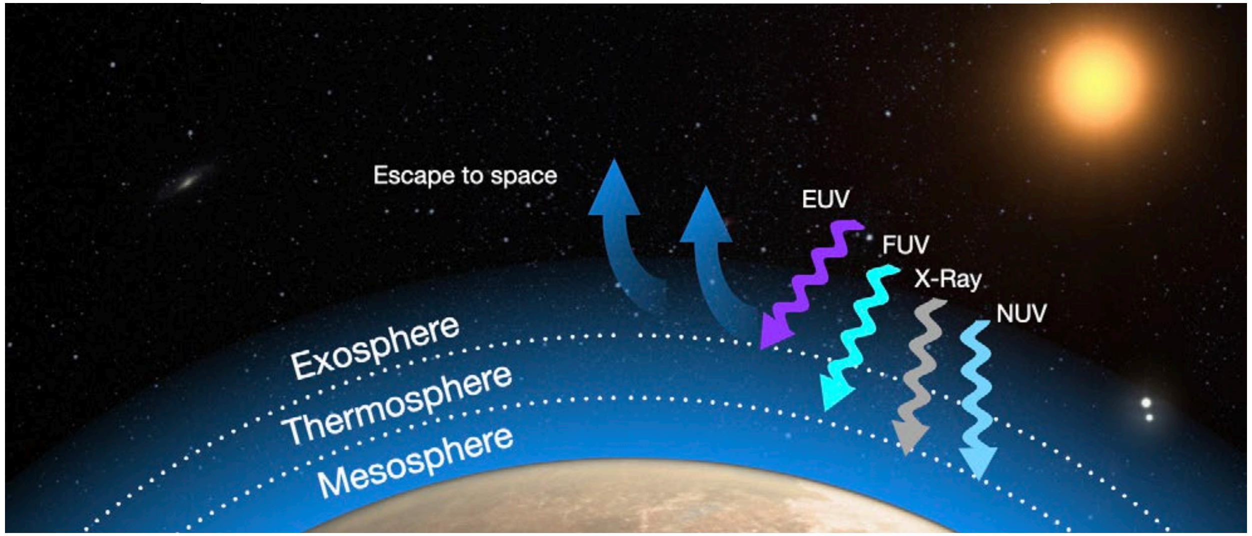
Pathways to Habitable Worlds

- How does a planet's interaction with its host star and planetary system influence its atmospheric properties over all time scales? (Worlds and Suns in Context focus area, Astro2020 Decadal Survey)
- EUV photons drive the escape of planetary atmospheres

What is the amount of ionizing energy incident on exoplanet atmospheres from their host stars?



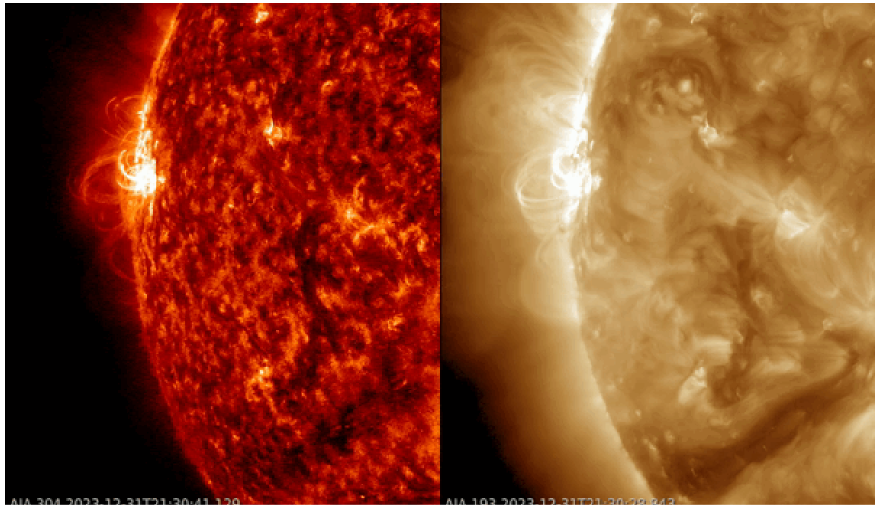
Predicted water loss from the Trappist-1 planets in units of "Earth oceans"



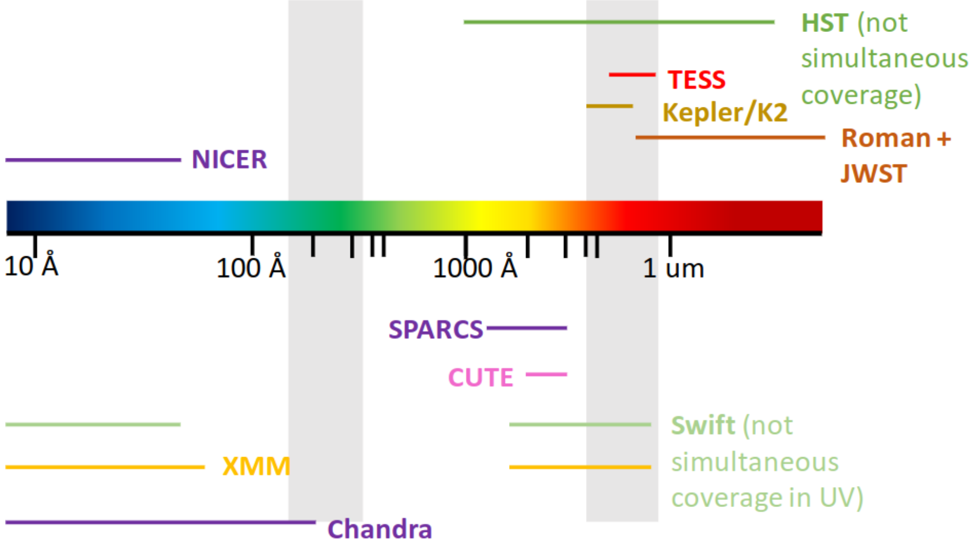
Stellar flares are ubiquitous – but how do they affect exoplanets?

- Wide field surveys like Kepler/K2 and TESS at visible wavelengths are driving an abundance of stellar flare research with applications to planets and habitability... but visible photons do not alter atmospheres!

Flares greatly enhance stellar EUV luminosity

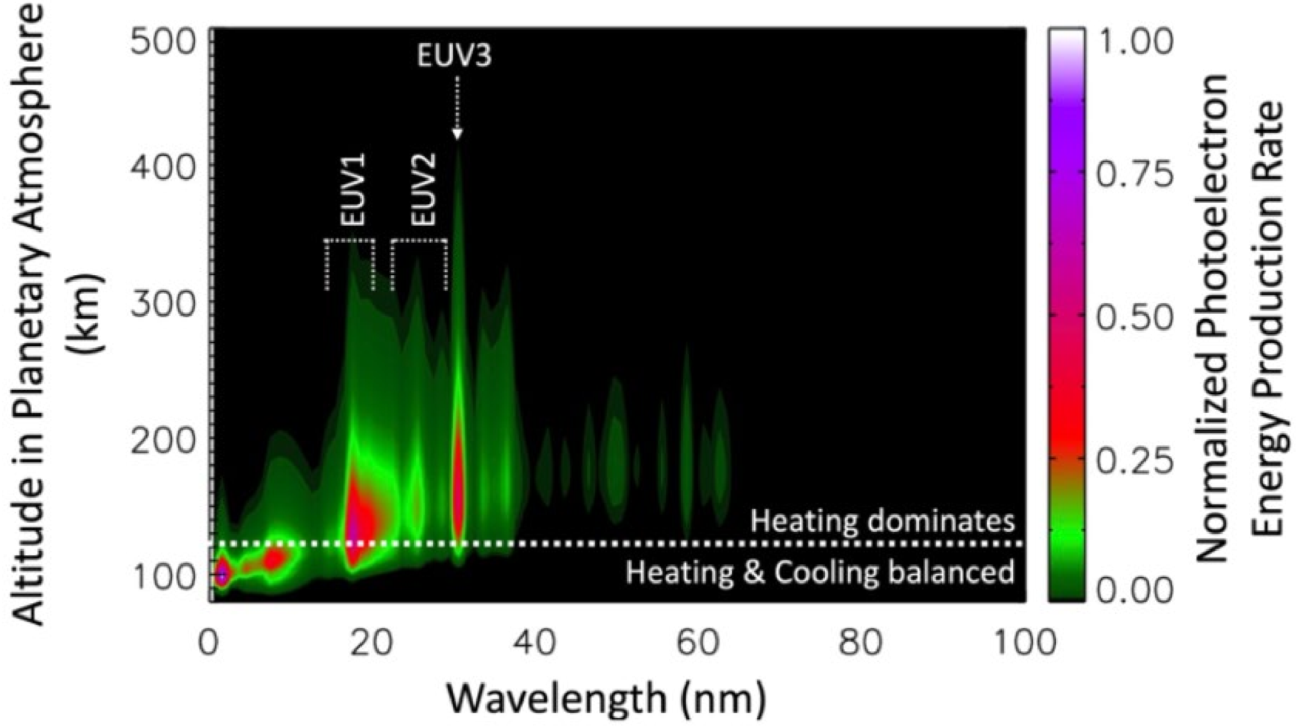


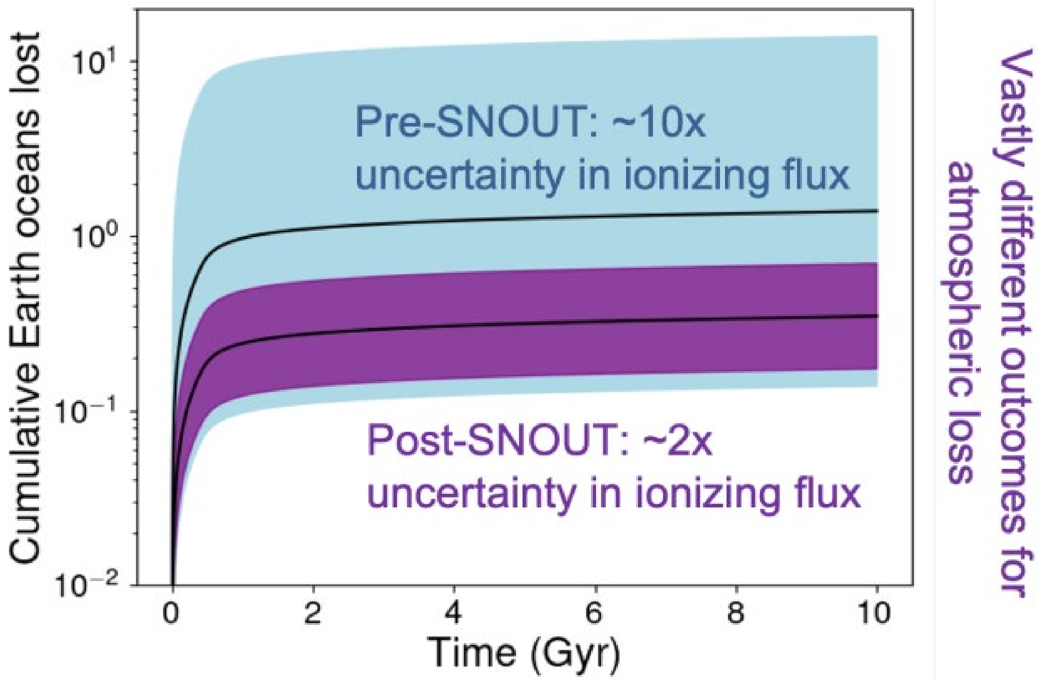
What is the relationship between white light flares and ionizing energy incident on exoplanets?



SNOUT: a Pioneers-class mission concept to simultaneously observe EUV and white-light from nearby, low-mass stars

SNOUT directly captures much of the effective ionizing flux during stellar quiescence and flaring with three, targeted EUV bandpasses

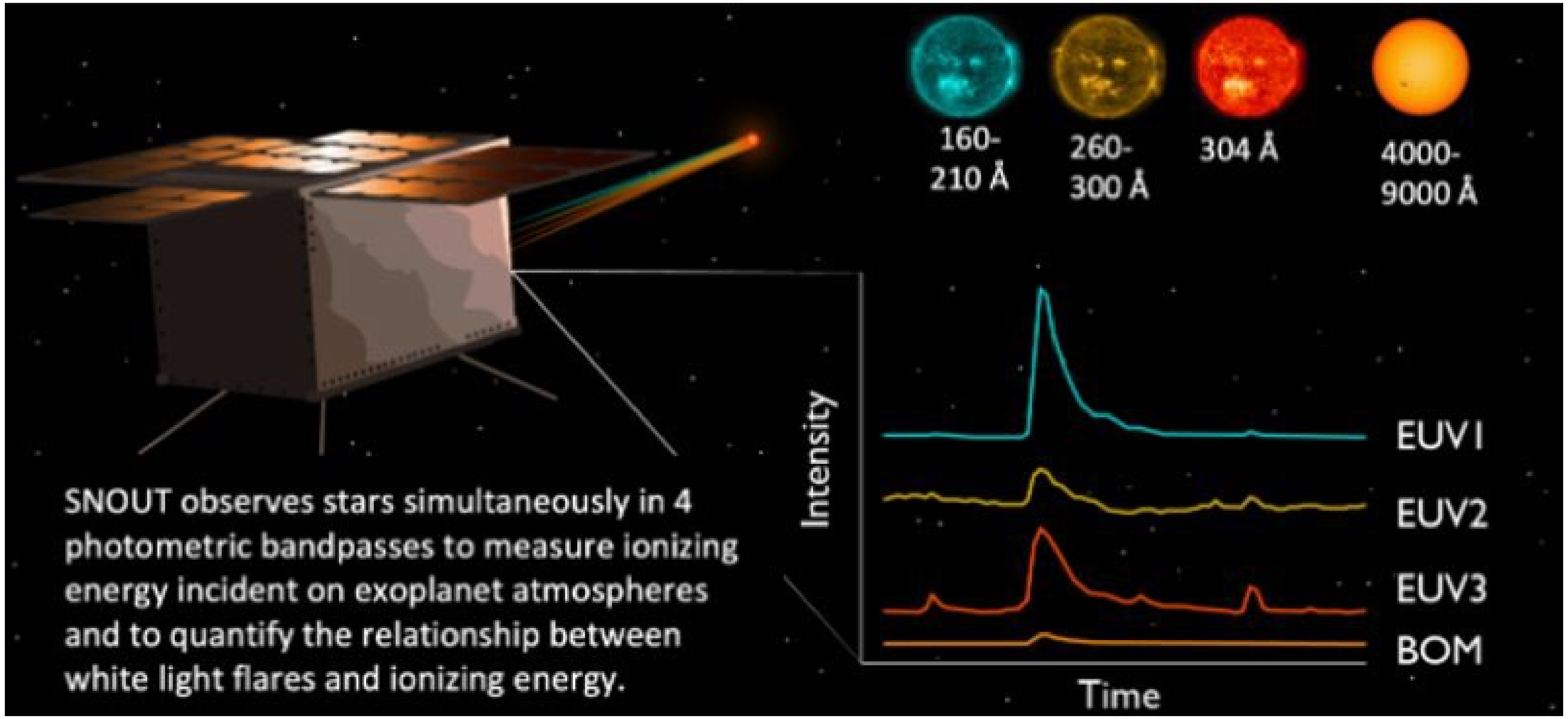




IOWA

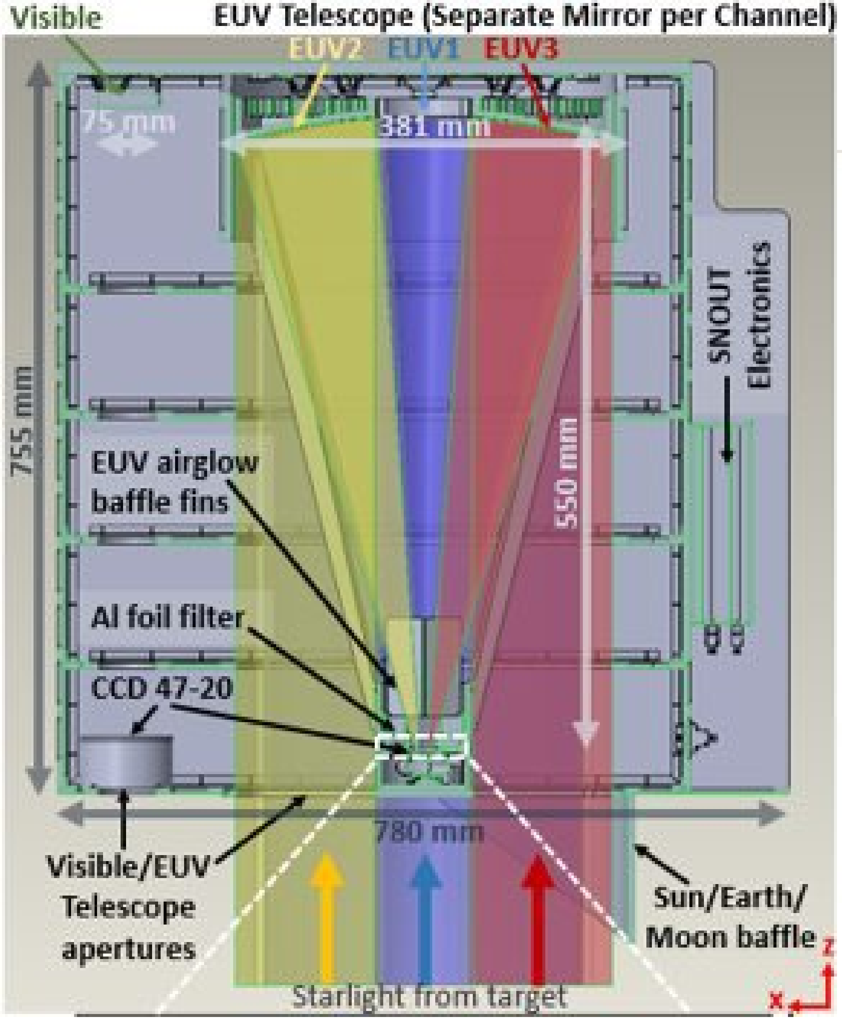
SNOUT: a Pioneers-class mission concept to simultaneously observe EUV and white-light from nearby, low-mass stars

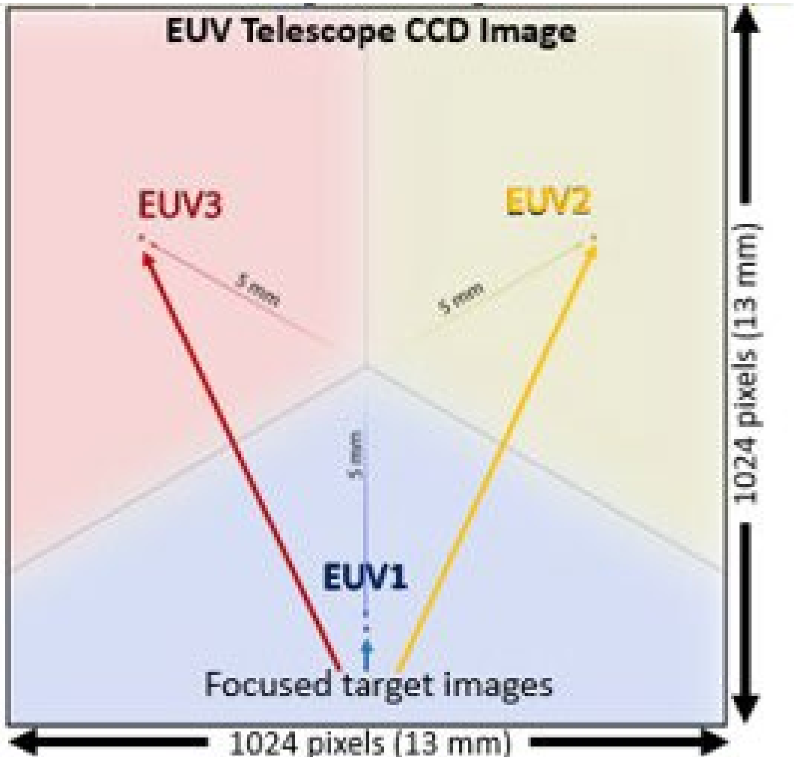
SNOUT contemporaneously observes its three EUV bandpasses, along with one white light channel, to determine the relationship between white light flares and the ionizing radiation released during them.



SNOUT: A SmallSat UV + Optical Telescope

Channel Name	Bandpass (nm)
EUV1	16-21
EUV2	24-29
EUV3	30-31
Visible	400-900





EUV Telescope: OAP, segmented 38 cm diameter with high-heritage Al foil filter

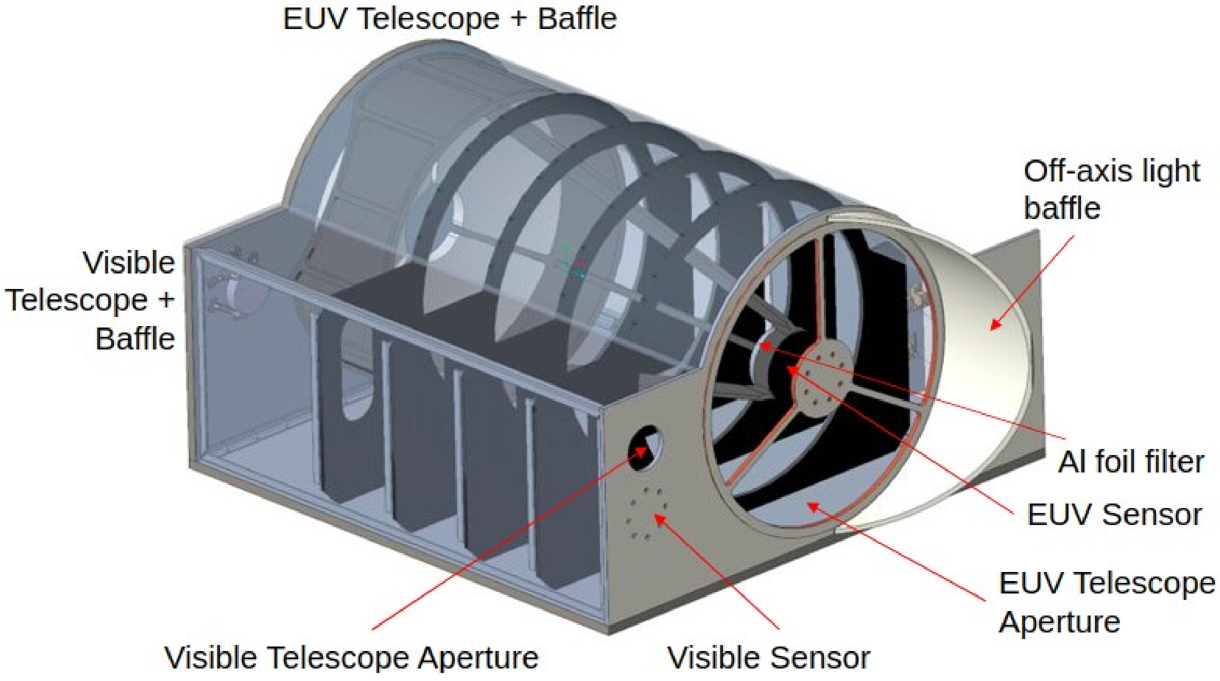
Visible Telescope: OAP, 7.5 cm diameter

Sensors: Teledyne e2v CCD 47-20

SNOUT: A SmallSat UV + Optical Telescope

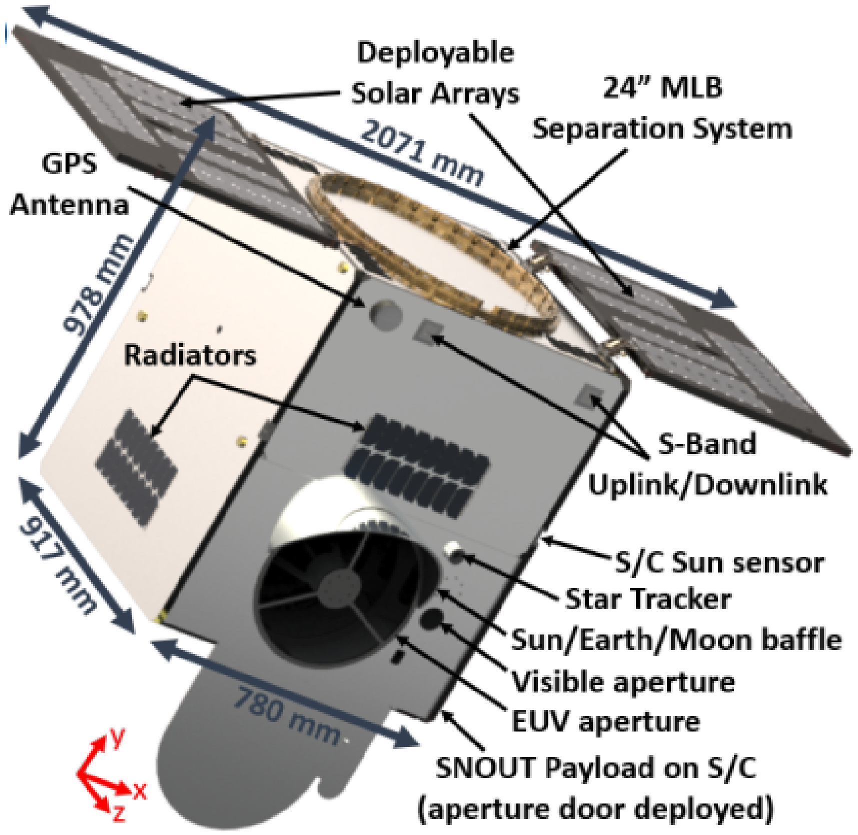
SNOUT is designed to fit within the payload allocation for an ESPA-Grande class spacecraft

SNOUT payload fits the baselined Spacecraft Bus with sufficient margin on mass (>50%), power (~20%), and data (>25%, with S-Band telemetry)

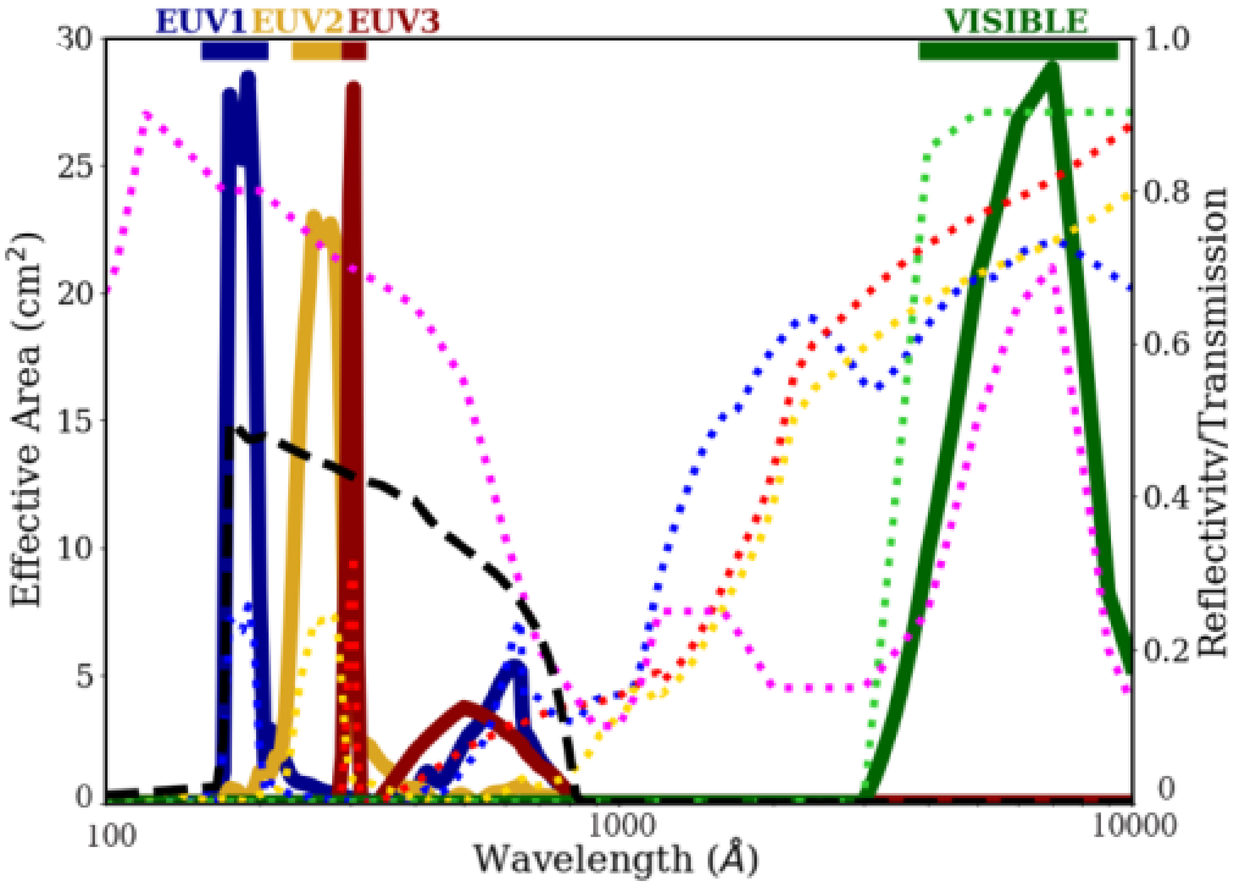


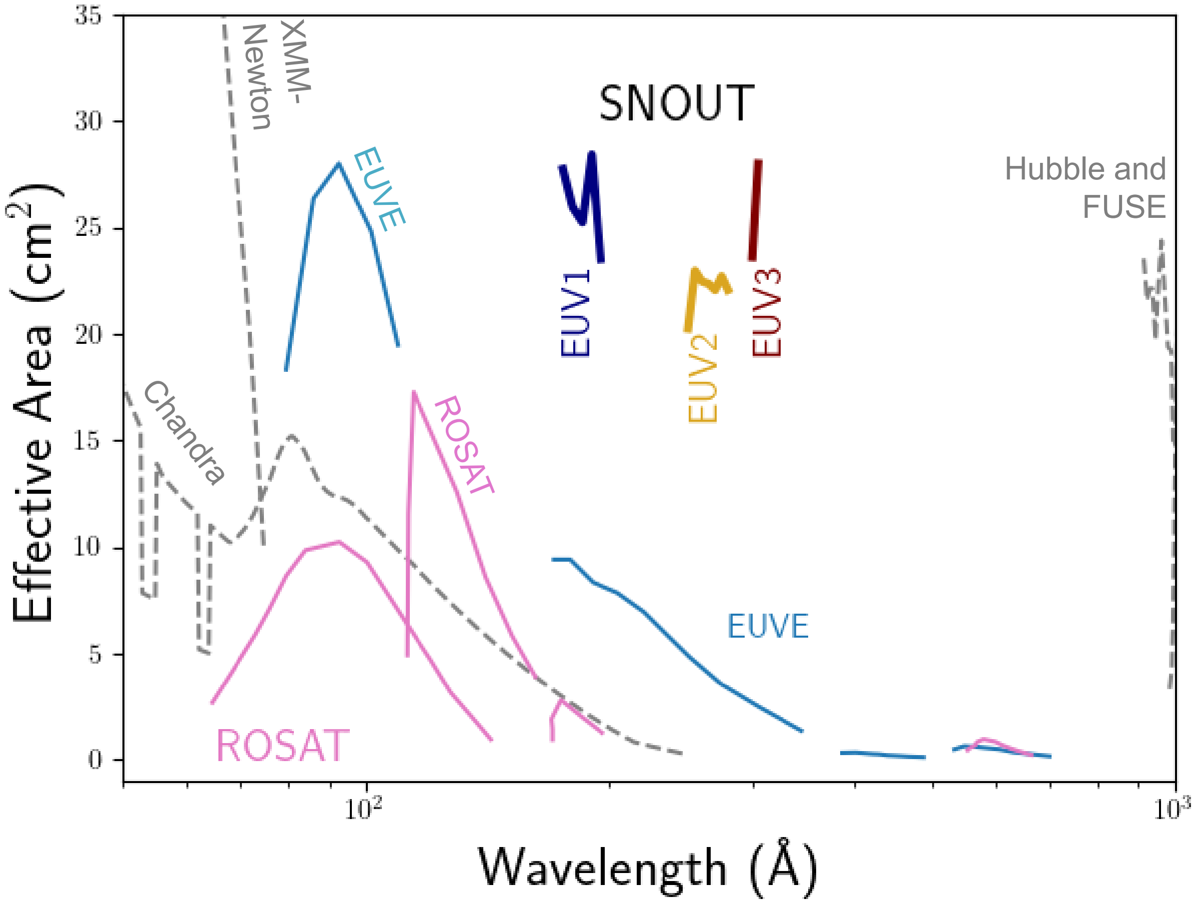
SNOUT payload design

SNOUT with baselined ESPA-Grande Spacecraft



SNOUT's Projected Performance





SNOUT has more sensitivity than past EUV missions, like EUVE or ROSAT

IOWA

Mission Concept

1 year mission, any LEO (500-600 km)

Observe 30 nearby stars (all over sky),
monitor over time for flares (5-min exposures)

Visibility for 10/30 SNOUT targets with total exposure times shown in black boxes

Summary

SNOUT will be the first EUV Astrophysics mission in over 20 years and will for the first time ever observe stellar flares simultaneously in the EUV and Visible.

SNOUT science is compelling and in line with high priority NASA Astrophysics objectives.

Mission scope is perfect NASA Pioneers class!