The CUTE small satellite mission

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Context: exoplanet population
Context: atmospheric escape

- Fulton+2017, 2018, van Eylen+2018
- Owen & Wu 2018
- Jin & Mordasini 2019
Context: atmospheric escape

Observable mostly at UV wavelengths!
Need to go to space

Fulton+2017, 2018, van Eylen+2018

Owen & Wu 2018
Jin & Mordasini 2019
Exoplanet transits
More than 1000 transiting planets with orbit < 10 days known to date, but only half a dozen have been observed in the UV.

UV observations are virtually limited to the Hubble Space Telescope.

Need of repeated observations.

Time dependent signatures – require continuous observations.

Need more planets to be observed.
Current status

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URGENTLY NEED TO REPEATEDLY OBSERVE MORE PLANETS AND FOR A LONGER TIME
FUV vs NUV

**FUV**
- Several resonance lines
- Abundant elements
- Low stellar flux
- Stellar variability

**NUV**
- Huge number of lines
- +/- Metals
- Mostly non-resonance lines
- High stellar flux
- Uniform background

**Transit signals >>1% -> small apertures possible**
The CUTE solution: motivation

TARGETS: Close in giant exoplanets (< 5 day orbital periods)

GENERATE: NUV Wavelength dependent transit light curves

DEDUCE: Exoplanet atmospheric properties
   - Geometry
   - Composition
   - Mass loss rates

BONUS: Detect/measure planetary magnetic field?
The CUTE solution: team

CUTE: Colorado Ultraviolet Transit Experiment

Kevin France [PI], Brian T. Fleming [Project Scientist] (UColorado, USA)

Science Team: Luca Fossati (A), Tommi Koskinen (USA), Aline Vidotto (IR), Jean-Michel Desert (NL), Matthew Beasley (USA), Pascal Petit (F)

Science team associates: Arika Egan (USA), A. G. Sreejith (A), Carolina Villarreal D'Angelo (IR)
The CUTE solution: payload (6U)

- Heat strap
- Radiator
- Spectrograph
- Instrument electronics
- S-band transmitter
- NUV telescope
- BCT Attitude control unit
The CUTE solution: optical system

Focal ratio: F/5.5; Spectral resolution: ~3000; Wavelength range: 2515 - 3300 Å; Field of view: 23'; Average effective area: 29 cm²; Primary aperture: 200 x 80 cm
The CUTE solution: optical system

**e2V CCD42-10**

- Heritage - Mars Science Lab ChemCam LIBS spectrometer (*Wiens+2012*)
- Relatively radiation resistant
- Actively cooled
- 27.6 x 6.9 mm (2048 x 515 pixels)

*Egan+2018*
The CUTE solution: spacecraft
The CUTE data simulator

Ra: 78.29554, Dec: 33.31817, Pos angle: 115.0, Slit pos: 0.0
Conclusion