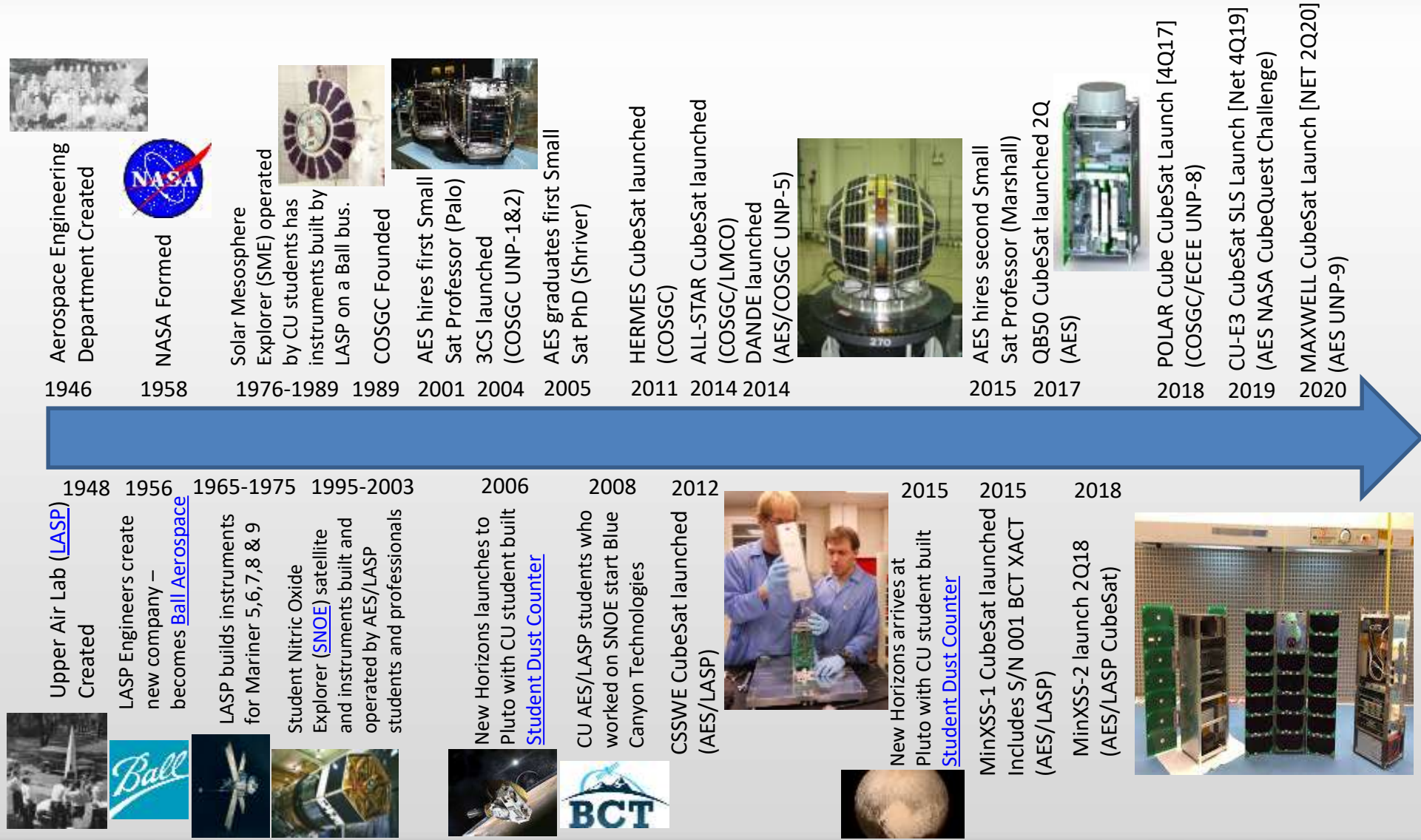


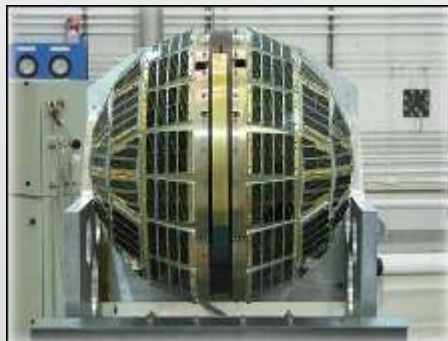
# A Brief (incomplete) Small Sat History @ CU



# Recent SmallSat work at CU



Jan 2007 – Mar 2014



DANDE (39267)  
Launch Sep 2013  
331x1426km 81°  
SpaceX Falcon-9 Flight #6



Aug 2009 - Jan 2015



CSSWE (38761)  
Launch Sep 2012  
442x777km 64.6°  
ULA Atlas V [NROL-36]

Heliophysics



Aug 2011 – May 2017



MinXSS-1 (41474)  
Launch Dec 2015  
402x402km 51.2° [ISS]  
ULA Atlas V [OA-4]



Jan 2014 - Present



Challenger (42721)  
Launch Apr 2017  
410x410km 51.2° [ISS]  
ULA ATLAS V [OA-7]

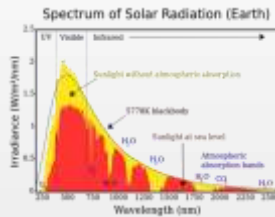


# Upcoming CU Cubesat Missions

Heliophysics



Earth Science



Space Science



Astrophysics



Centennial Challenge



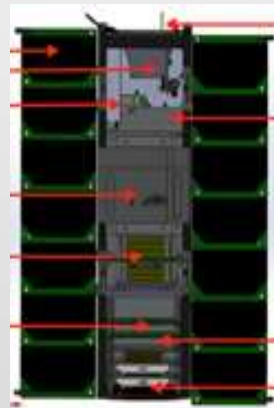
MinXSS-2

Launch 2Q18  
SSO 575km



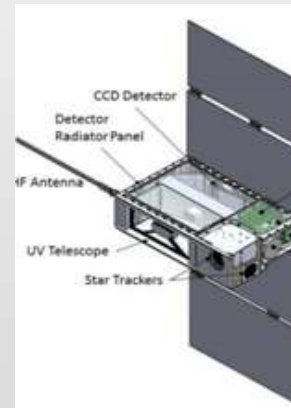
CSIM

Launch 3Q18



INSIPRE-SAT

Launch 4Q19



CUTE

Launch 1Q20



CU-E<sup>3</sup>

Launch NET 4Q19



MAXWELL

Launch NET 2Q20





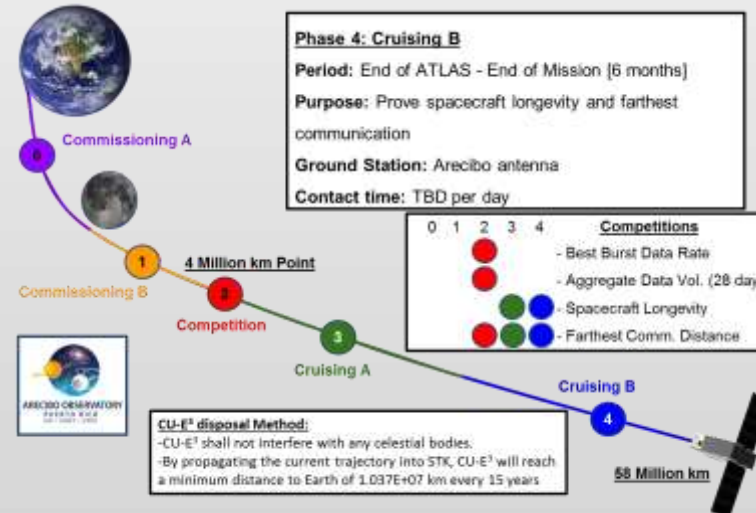
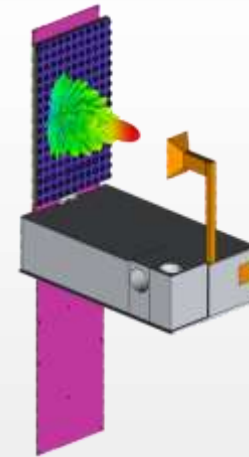
Part of the NASA CubeQuest Challenge  
 Demonstrate Deep Space CubeSat Com  
 Placed 4<sup>th</sup> in ground tournament #2  
 Placed 3<sup>rd</sup> in ground tournament #3  
 Placed 2<sup>rd</sup> in ground tournament #4  
 Selected for launch on EM-1



# CU-E3

## Colorado Earth Escape Explorer

Enabled through AES graduate projects curriculum  
 Builds on prior hardware development – X-band radio  
 Prototyping novel X-band reflectarray  
 Leverage partnerships  
 BCT – XB1 small satellite bus with XACT ADCS  
 ATLAS ground station resources  
 Scheduled delivery, 2Q17



# The Colorado Ultraviolet Transit Experiment (CUTE)

A Dedicated Cubesat Mission for the study of Exoplanetary Mass Loss and Magnetic Fields

## University of Colorado:

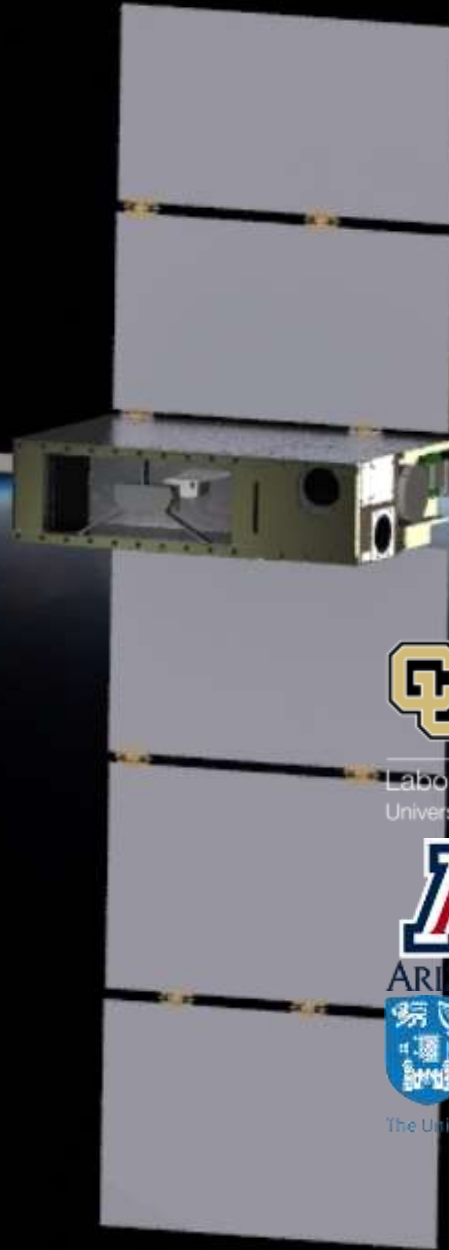
Kevin France (PI), Brian Fleming (PS), Nicholas Nell, Richard Kohnert (PM), Kelsey Pool, Arika Egan, Keri Hoadley, Stefan Ulrich

## United States:

Tommi Koskinen (UoA), Matthew Beasley (PRI)

## Europe:

Luca Fossati (ÖAW), Aline Vidotto (TCD), Jean-Michel Desert (Amsterdam), Pascal Petit (UdT)

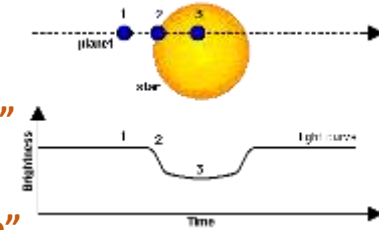
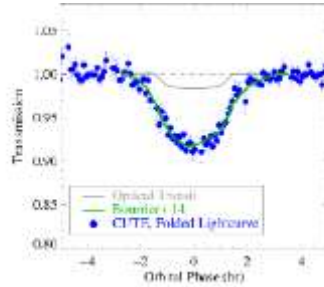


# Colorado Ultraviolet Transit Experiment (CUTE): Mass-Loss and Magnetic Fields in Extreme Environments

Kevin France – University of Colorado

Objectives and NASA's Strategic Goals:

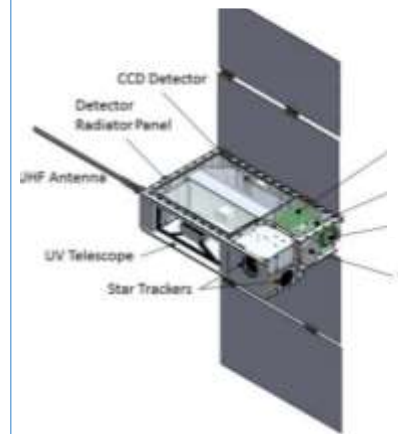
“Seeking to discover and study planets orbiting other stars”  
“Advance the Nation’s STEM education and workforce pipeline”



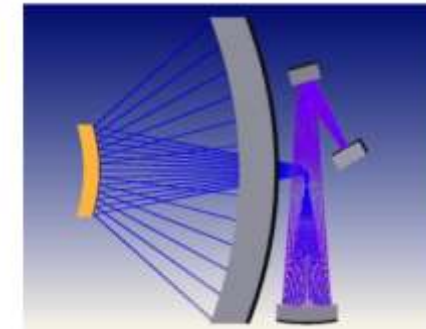
- **Escaping atmospheres** of short-period planets are best probed with high-opacity atomic species entrained in the outflow found at ultraviolet wavelengths
- The presence and strength of **(exo)planetary magnetic fields** can be diagnosed by studying transit light curve asymmetries.
- CUTE will carry out near-UV transit spectroscopy to measure atmospheric escape rates and potentially discover magnetic fields on 12 – 20 short-period planets over a 7 month science mission

## Status and Approach

- NASA-supported program (2017) employing a team of undergraduate and graduate students from science and engineering departments as well as LASP researchers and faculty.
- Expose students to a *complete* NASA mission: from proposal to development to launch
- Orbital observatory-class science on a suborbital budget
- Nominal Q1-2020 launch

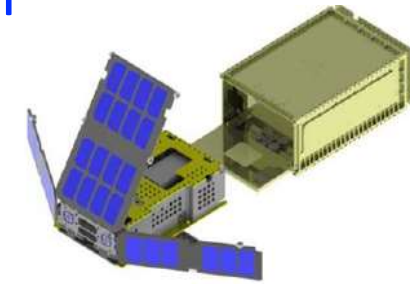


6U cubesat (BCT) housing an  $f/2.6$  Cassegrain telescope feeding a compact, low resolution ( $R = 3000$ ) spectrograph operating from 2550 – 3300 Å. The spectrogram is recorded on a UV-optimized e2v CCD.

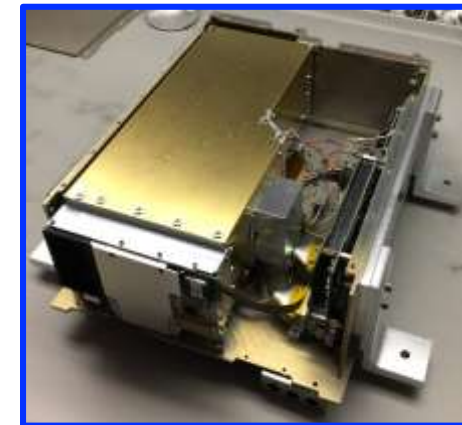
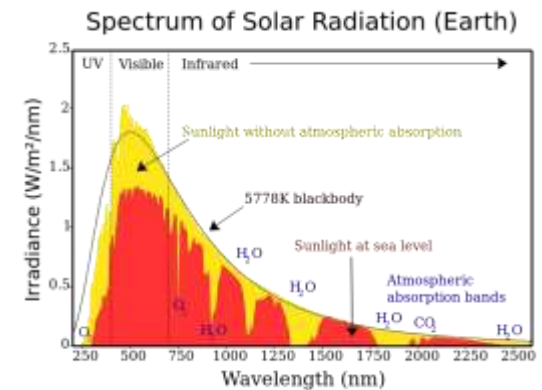


# Compact Spectral Irradiance Monitor (CSIM) CubeSat

*PI: Dr. Erik Richard*



- NASA Earth Science division science mission to fill the climate record gap for the solar spectral irradiance (SSI) in the 200-2400 nm range (near UV, visible, near IR).
- 6U CubeSat with CSIM prism spectrometer and with spacecraft bus from Blue Canyon Technologies (BCT).
- CSIM CubeSat launch is planned for Sept. 2018 into SSO at 500 km altitude for a 5-year mission.
- New S-band ground station is being added this year.



CSIM is 3<sup>rd</sup> generation of SIM and is 1/10 the mass of original SIM

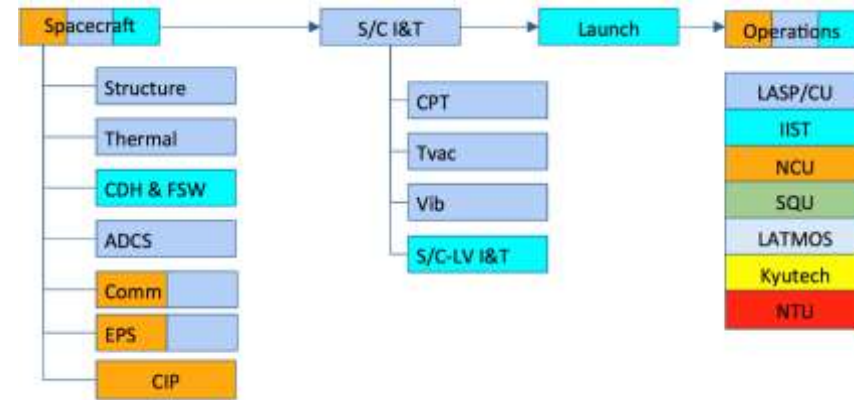
# INSPIRESat-1 Summary

## INSPIRESat-1 – Science Objectives

- Observe occurrence and evolution of equatorial Plasma bubbles.
- Observe Midnight Temperature Maximum features.
- Observe Ion/electron temperatures, density and velocities

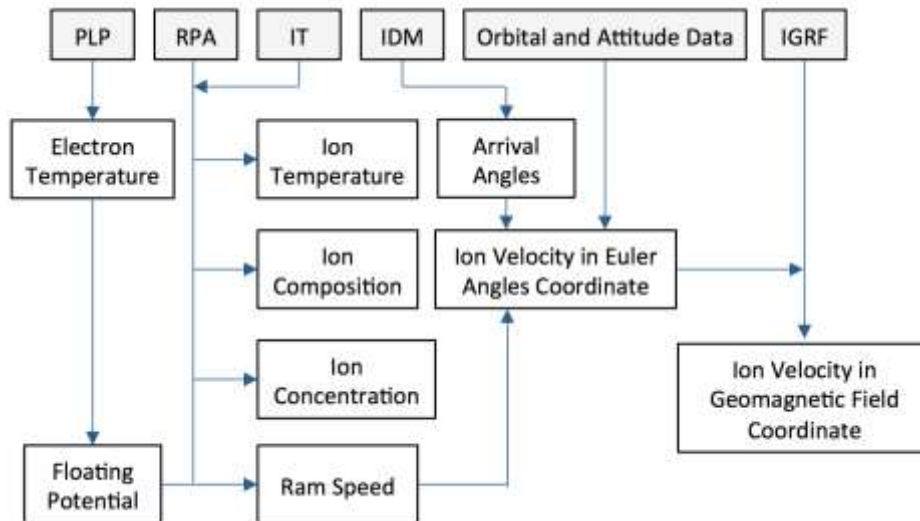
The Compact Ionosphere Probe consists of a Planar Langmuir Probe, Retarding Potential Analyzer, Ion Trap and Ion Drift Meter

## INSPIRESat-1 Breakdown of Responsibilities



- INSPIRESat-1 is scheduled for launch in Q4 of 2019 on an ISRO PSLV
- The satellite is being built jointly by CU, NCU (Taiwan) and IIST (India)

## INSPIRESat-1 - Ionosphere observations



## INSPIRESat-1 Assembly

