DAPPER

Dark Ages Polarimeter PathfindER

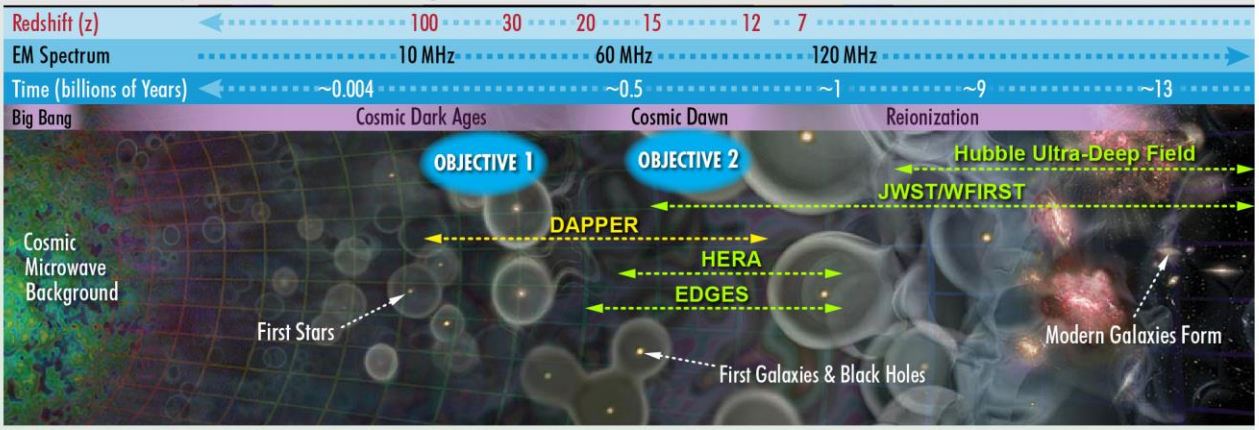
DARK COSMOLOGY:
INVESTIGATING DARK MATTER IN THE DARK AGES

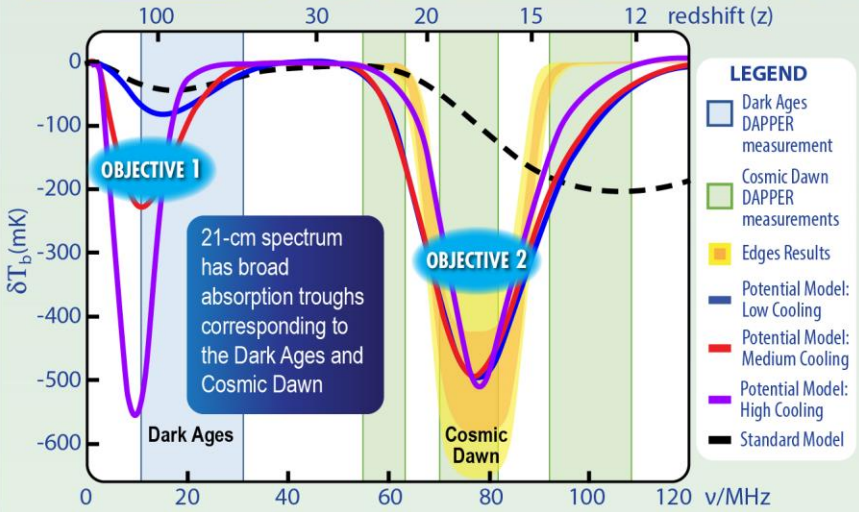
SCIENCE

OBJECTIVE 1:
- Determine the level of (dis)agreement with the standard cosmological model caused by dark matter in the Dark Ages.

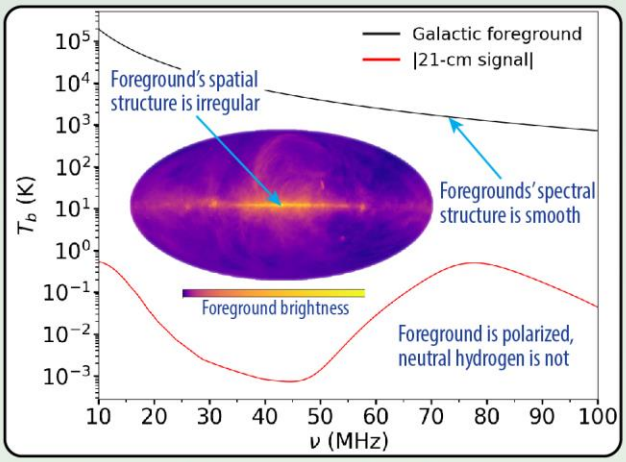
OBJECTIVE 2:
- Determine the level of excess cooling above the adiabatic limit for Cosmic Dawn.
- Determine when the first stars and black holes formed.

Will the observed behavior of redshifted neutral hydrogen redefine the standard cosmological model?





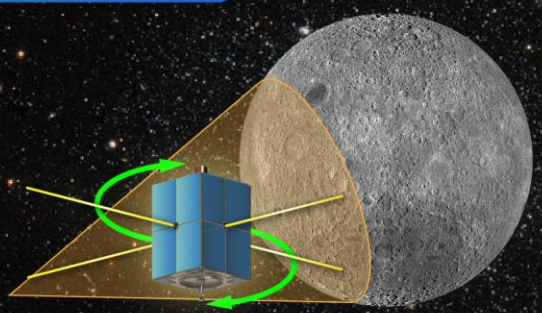
DAPPER uses the 21-cm all-sky signal to observe redshifts z = 83-12, associated with the Dark Ages and the Cosmic Dawn.



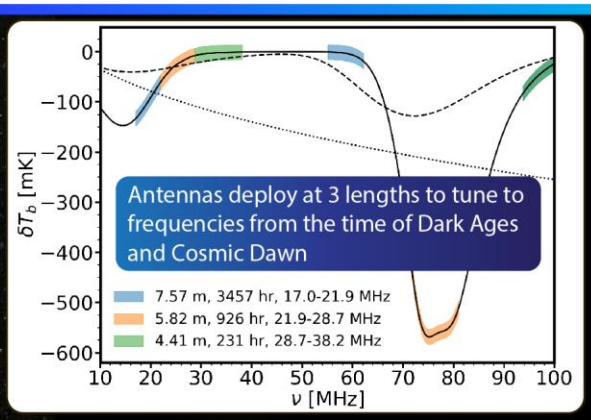
DAPPER separates Galaxy foreground from 21-cm signal using differences in spectral shapes, spatial structure, and polarization.

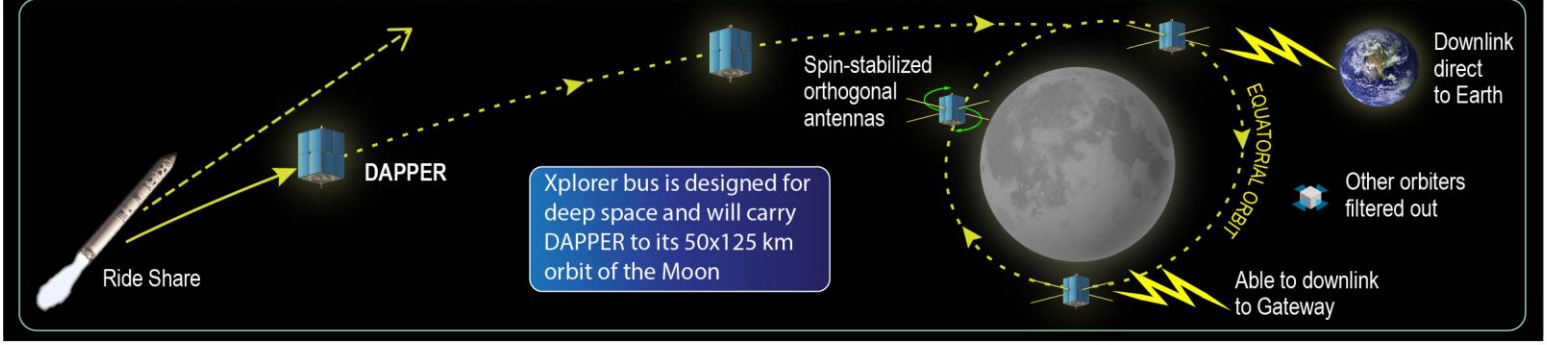
MISSION CONCEPT

The Moon shields DAPPER from Earth's RFI noise



Orthogonal antennas capture emissions of redshifted hydrogen; spinning allows polarimetry





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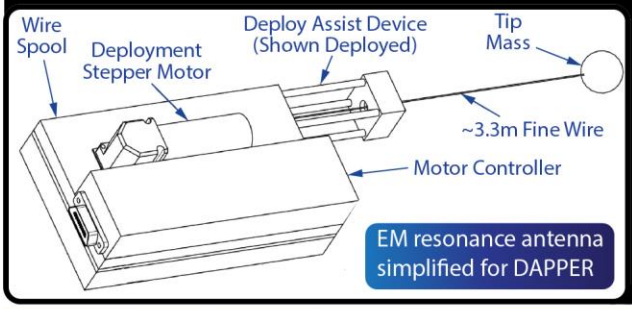
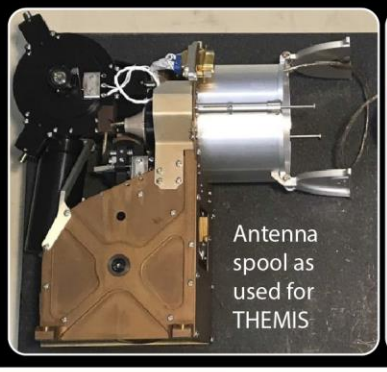
INSTRUMENT

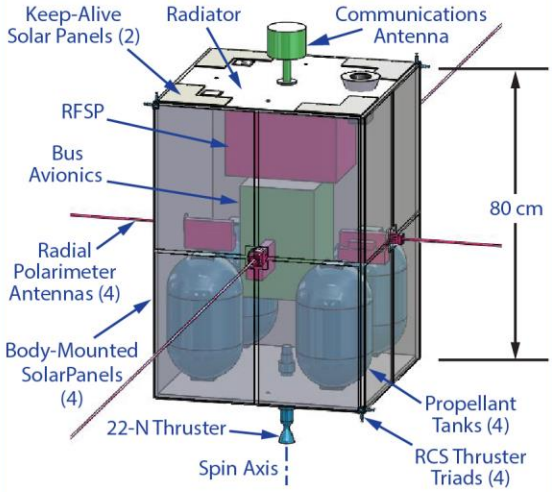
Thermally robust antennas have been deployed in near-sun environment and in deep space.





Spectrometer/Polarimeter used for Parker Solar Probe

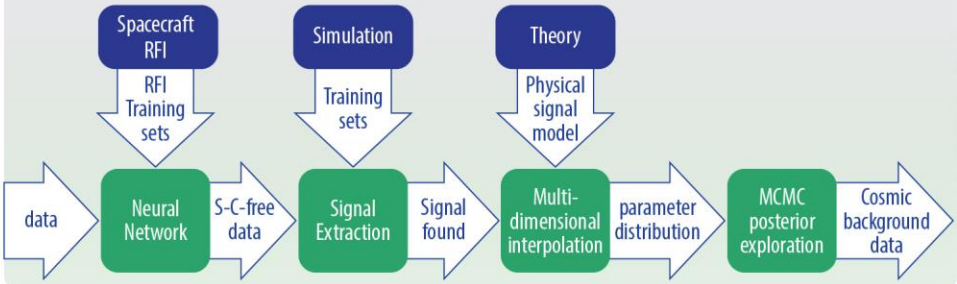
BRADFORD'S Xplorer SPACECRAFT



Spinning not only allows polarimetry but also stabilizes attitude and temperature.

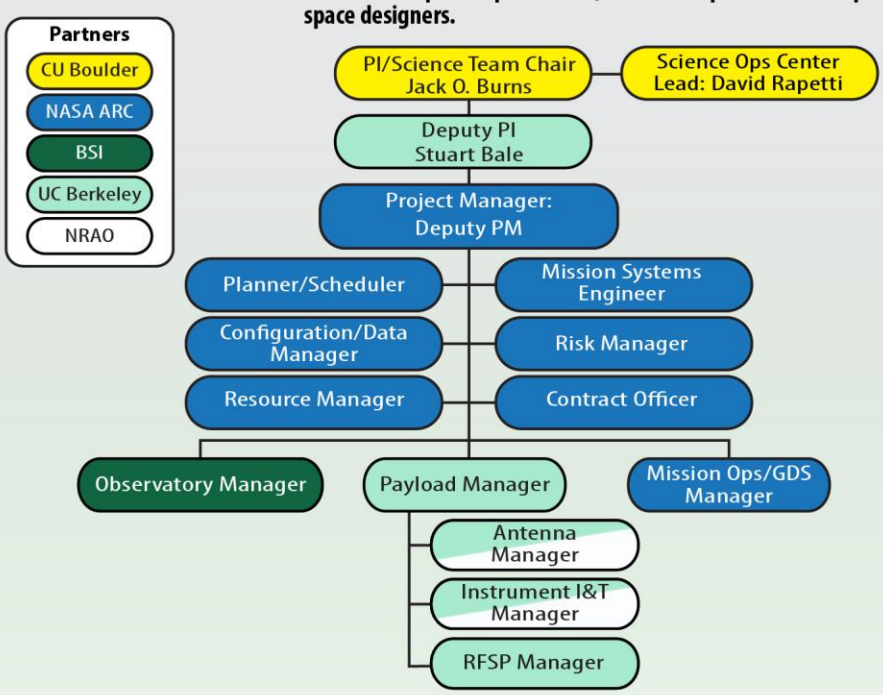
DATA PROCESSING PIPELINE

Pipeline uses pattern recognition and training sets to separate signal from known S/C, foreground, and systemic effects, and then fits cosmological models to the data.



DAPPER ORGANIZATION

DAPPER's mission team combines polarimetry experience, signal extraction supercomputer skills, smallsat expertise and deep space designers.

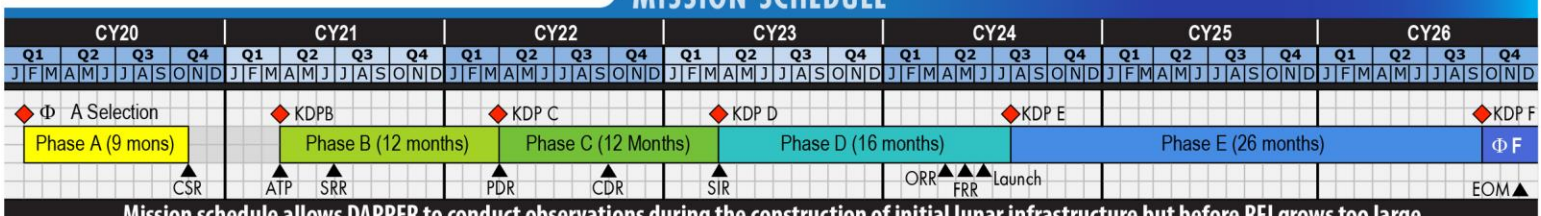


MANAGEMENT & ORGANIZATION

DAPPER SCIENCE TEAM

Member	Role	Institution
J. Burns	PI	University of Colorado
S. Bale	Co-I	UC Berkley
R. Bradley	Co-I	NRAO
N. Bassett	Grad Student	University of Colorado
D. Bordenave	Grad Student	University of Virginia
J. Bowman	Collaborator	ASU
H. Falcke	Collaborator	Radbound University
S. Furlanetto	Collaborator	UCLA
M. Klein-Wolt	Collaborator	Radbound University
R. MacDowall	Collaborator	NASA GSFC
J. Mirocha	Collaborator	McGill
B. Nhan	Collaborator	University of Virginia
D. Rapetti	SOC Lead	University of Colorado
K. Tauscher	Grad Student	University of Colorado

MISSION SCHEDULE



Mission schedule allows DAPPER to conduct observations during the construction of initial lunar infrastructure but before RFI grows too large.