Faraday Effect Tracker of Coronal and Heliospheric Structures (FETCH): Instrument Concept

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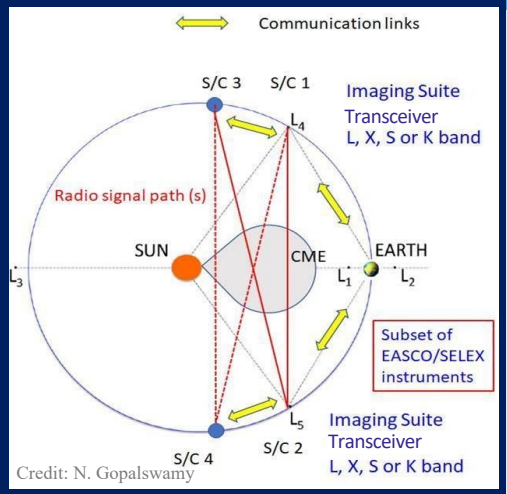
Multiview Observatory for Solar Terrestrial Science (MOST): Mission Concept



MOST Instruments
Magnetic and Doppler Imagers (MaDI)
Inner Coronal Imager in EUV (ICIE)
Hard X-ray Imager (HXI)
White-light Coronagraph (WCOR)
Faraday Effect Tracker of Coronal and Heliospheric structures (FETCH)
Heliospheric Imager with Polarization (HIP)
Radio and Plasma Wave Instrument (M/Waves)
Energetic Particle Detector (EPD)
Solar Wind Magnetometer (MAG)
Solar Wind Plasma Instrument (SWPI)

- **4 spacecraft (s/c)**:
  - 2 large s/c: at Lagrange points L4 & L5
  - 2 smaller s/c: one ahead of L4, one behind L5
- **Radio suites on all 4 s/c**

Motivations for MOST and FETCH

- Solar disturbances and wind are magnetic by nature
- Observations of **magnetic field structure** in solar wind, coronal mass ejections (CMEs), stream interaction regions (SIRs), and shocks **upstream of Earth and L1**
- Multiple spacecraft → multiple viewpoints / lines-of-sight
- **Absence of ionosphere** in space-based FR

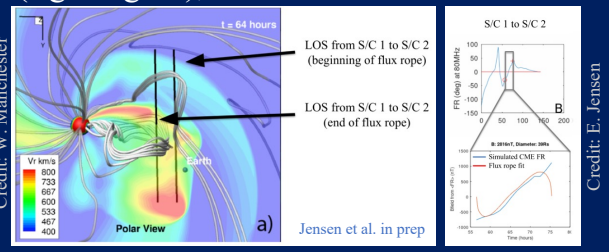
FETCH CME Science

- **Will probe magnetic field structure and CME evolution using Faraday rotation (FR) from $15R_\odot$ to 0.5 AU**
  - Four lines-of-sight upstream of Earth, entirely outside the ionosphere
- Radio frequency bandpass: **1-100 MHz**

Science Objectives	Required Measurements: Physical Parameters	Required Measurements: Observables
Within CME structure, determine the distribution in the plane-of-sky bulk velocity, average density, & magnetic field at varying distances from the Sun	CME <B>, from Faraday rotation (FR), dFR, total electron content (TEC), and dTEC	Stokes parameters I- total intensity, Q, U- linear polarization, V- circular polarization
Analyze force balance within CMEs	CME <N>, from TEC and dTEC	Time delay (group velocity) & frequency fluctuations

Significance of FETCH Measurements:

- **Space weather implications**: magnetic topology of solar wind and CMEs upstream of Earth
- **Present modeling efforts:**
  - 2005 CME event (left figure), detectable fluctuations (e.g. Alfvén waves), multi-LOS FR (right figure), transmitter-receiver antenna designs



Broader Impacts

- **Collaboration and interdisciplinary efforts:**
  - Complementary MOST instruments: HIP, WCOR
  - Context measurements: Global Oscillation Network Group (GONG) and ngGONG
- **Reach out; get involved:**
  - FETCH: Dr. Jensen (ejensen@psi.edu)
  - MOST: Dr. Gopalswamy (natchimuthuk.gopalswamy-1@nasa.gov)

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