Summary on Option-A

H. Hara (NAOJ)

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Prime Mission Description

- Explore the origin of solar magnetic activity cycle from out-of-ecliptic observations

  (observations: helioseismic, total irradiance, TR & coronal imaging/spectroscopy, and heliospheric, and in-situ observations)

Option-A related Sub-WG Activity

- Helioseismology and Dynamo sub-WG
  - Reported by Sekii, Brun, Kosovichev, Appourchaux(Solar Orbiter), Finsterle (TSI)
- Engineering (Orbit and Spacecraft) sub-WG
  - reported by Kawakatsu

  Important steps given from the previous science meeting. Orbit & S/C are becoming feasible.
- UV/EUV sub-WG
  - Reported byTeriaca
- X-ray telescope sub-WG
  - Reported by Korreck
- Other (heliospheric physics)
  - Reported by Isobe, Hara

Can we send S/C to the vantage point ? Orbit & Spacecraft

- Two orbit candidates shown with investigations of S/C feasibility.
- **Final orbit**: 1 yr period, 1.0 AU circular
  40 deg max heliosphehic-latitude
  rotating the Sun synchronized with Earth
  - SEP Option: technical challenges driven by presence of ion engines. Maybe limited observing opportunity in the first few years.
  - Jupiter Option: probably conservative orbit methodology. Limited data rate in the first 4 years.
- Which will be preferable from various points including the technical readiness? This is an important input to engineering group.

Helioseismology & Dynamo

- Expected outcome
  - Meridional flow
    - where and how the flow sinks
    - How it evolves in the 11-yr activity cycle
  - Differential rotation
    - all latitudes covered
  - Convective structures and its evolution in high latitudes
  - Motions of magnetic structures in high latitudes
  - Polar field evolution

Discussions (1)

- Will it really work for advancing the resolution of the dynamo problem?
  - No question! Selection of the final S/C orbit is appropriate for the dynamo issues.
  - If the signature of magnetic flux tube in CZ is found, it will be an additional big jump.

Discussion (2)

- Multi-instrument helioseismology to first see the deep convection zone in a good accuracy. Possible?
  - Timing is not a problem [done by SOHO + obs. at Earth]
  - Spatial co-registration (knowledge of geometry for two spacecrafts) not a problem.
  - Minimize instrumental effects by using the same observables and the same line

- Can we use an imaging photometer for helioseismology? [not preferred]
  - S/N is about 10 times lower in intensity
  - More modes observed in velocity

Discussion (3)

- Can a huge telescope in ecliptic be replaced regarding the Option-A science?
  - Short time coverage near polar regions
  - Field-of-view is small to see the deep CZ
- Solution of spacecraft at L5 (L4) reasonable to do helioseismology?

  [for some specific problem]
  - Large angle helioseismology limited near equatorial tachocline, no gain in high latitude regions

Discussion (4)

- Why 40 deg?
  - Latitude of 0-60 deg covered with MDI
  - 30 deg appears to be the minimum number, but not correct (see Sekii's presentation)
  - For spatial integration, 30+α deg required in helioseismology

  - What α is actually needed?

    α=10 deg is a value from helioseismology

Discussion (5)

- Difference with Solar Orbiter
  - Continuous observations at any orbital phase in the final orbit
  - Fast arrival at high inclination orbit for a S/C mission life
  - Duration of observations at inclination above 30 deg:

    >60 days for each hemisphere vs ~20 days in SO
  - Higher telemetry rate by a factor of >7 at least for helioseismic observations. Much higher rate is possible when S/C approaching to the Earth at lower latitudes
  - Contain TSI observation
  - Thermally stable observing conditions at 1 AU
  - Complementary mission

Discussion (6)

- Difference with SDO
  - Polar regions covered
  - Complementary mission

Discussion (7)

- Other science topics
  - Thank you for inputs by Luca Teriaca on solar wind, by Kelly Korreck on the coronal imaging
  - But some topics are raised from Option-A supporters
    - Heliospheric imaging observations by H. Hara and H. Isobe who inspired by STEREO-HI observations
    - Cosmic ray observations by Hiroaki Isobe who inspired by Ulysses results
  - Need to define the role of in-situ measurements more clearly

Toward Mission Proposal for Option-A

- Prime description of the Mission
  - Science goals
- Payload to achieve the science goals
- Technical feasibility and readiness

- International Option-A Team framework