Science Activity Plan (SAP)

The latest version (v0.1, 10 July 2017) of the full SAP document can be downloaded here.

N.B.: The individual Confluence pages might contain more recent information than the full SAP document.

- Solar Orbiter detailed science objectives
  - Objective 1: What drives the solar wind and where does the heliospheric magnetic field originate?
    - 1.1 What are the source regions of the solar wind and heliospheric magnetic field?
      - 1.1.1 Source regions of the fast solar wind
        - 1.1.1.1 Low FIP fast wind origins
        - 1.1.1.2 Origin of the small-scale X-ray and UV jets in polar coronal holes
      - 1.1.2 Source regions of the slow solar wind
        - 1.1.2.1 Does slow wind originate from the over-expanded edges of coronal holes?
        - 1.1.2.2 Does slow and intermediate solar wind originate from coronal loops outside of coronal holes?
        - 1.1.2.3 Abundance of minor ions as a function of height in the corona as indicator of slow or fast wind
        - 1.1.2.4 Study of density fluctuations in the extended corona as a function of the outflow velocity of the solar wind while evolving in the heliosphere
        - 1.1.2.5 Structure and evolution of streamers
        - 1.1.2.6 Disentangle the spatial and temporal variability of the slow wind
        - 1.1.2.7 Trace streamer blobs and other structures through the outer corona and the heliosphere.
        - 1.1.2.8 Determine the velocity, acceleration profile and the mass of the transient slow wind flows
      - 1.1.3 Source regions of the heliospheric magnetic field
        - 1.1.3.1 Full characterization of photospheric magnetic fields and fine structures
        - 1.1.3.2 How does the Sun's magnetic field link into space?
          - 1.1.3.2.1 How does the Sun's magnetic field change over time?
          - 1.1.3.2.2 How is the heliospheric current sheet (HCS) related to coronal structure?
          - 1.1.3.2.3 How does the heliospheric magnetic field disconnect from the Sun?
        - 1.1.3.3 What is the distribution of the open magnetic flux?
      - 1.1.4 Transverse themes
        - 1.1.4.1 Reconnection
          - 1.1.4.1.1 Interchange reconnection between open and closed field lines and its role in slow wind generation
          - 1.1.4.1.2 Identify coronal reconnection sites by measuring impulsive event material
          - 1.1.4.1.3 Identify reconnection exhausts in the solar wind
          - 1.1.4.1.4 Current sheets inferred by determining the magnetic field geometries at local chromospheric heating sites
          - 1.1.4.1.5 Identify and characterise the solar wind reconnection physics in current sheets with thickness down to the ion scales and smaller
          - 1.1.4.1.6 Photospheric reconnection
          - 1.1.4.1.7 Electron acceleration in coronal reconnection regions
          - 1.1.4.1.8 Formation of flux ropes/CMEs via magnetic reconnection in the corona
    - 1.2 What mechanisms heat the corona and heat and accelerate the solar wind?
      - 1.2.1 What mechanisms heat the corona?
        - 1.2.1.1 Energy flux in the lower atmosphere
        - 1.2.1.2 Energy and mass flux in the corona.
        - 1.2.1.3 Contribution of flare-like events on all scales
        - 1.2.1.4 Observe and explore flare-like ‘heating events’ from the quiet corona
        - 1.2.1.5 Determine whether coronal heating is spatially localized or uniform, and time steady or transient or impulsive for a wide range of magnetic loops with different spatial scales.
        - 1.2.1.6 Resolve the geometry of fine elemental loop strands
        - 1.2.1.7 Detect and characterise waves in closed and open structures
        - 1.2.1.8 Investigate the role of small scale magnetic flux emergence in energizing the above laying layers
        - 1.2.1.9 Multi-temperature diagnostics of flaring coronal loops
        - 1.2.1.10 Heating in flaring loops vs heating in active regions
      - 1.2.2 What mechanisms heat and accelerate the solar wind?
        - 1.2.2.1 Determine where energy is deposited in the solar wind
        - 1.2.2.2 What drives the evolution of the solar wind distribution functions in situ?
        - 1.2.2.3 What is the nature and origin of waves, turbulence and small-scale structures?
        - 1.2.2.4 Solar wind reconnection physics
        - 1.2.2.5 Magnetic reconnection in the chromosphere, the transition region and the corona
        - 1.2.2.6 Study fast plasma flows from the edges of solar active regions discovered with Hinode/EIS
        - 1.2.2.7 Study the correlation degree between velocity and magnetic field fluctuations in the interplanetary space
        - 1.2.2.8 What determines the azimuthal flow of the near-Sun solar wind?
    - 1.3 What are the sources of solar wind turbulence and how does it evolve?
      - 1.3.1 Solar and local origin of Alfvénic fluctuations
      - 1.3.2 How is turbulent energy dissipated and how does turbulence evolve within the heliosphere?
      - 1.3.3 Plasma turbulence variability
      - 1.3.4 Plasma turbulence anisotropy
  - Objective 2: How do solar transients drive heliospheric variability?
    - 2.1 How do CMEs evolve through the corona and inner heliosphere?
      - 2.1.1 What are the global structure, initiation, and evolution of CMEs?
        - 2.1.1.1 CME initiation
        - 2.1.1.2 CME structure
        - 2.1.1.3 CME evolution
    - 2.2 How do CMEs contribute to solar magnetic flux and helicity balance?
      - 2.2.1 How do CMEs contribute to the global evolution of magnetic flux in the heliosphere?