1.1.2.5 Structure and evolution of streamers

Description of the objective:

The extended observation at the limb of the same portion of the corona is essential to address the study of streamer structure, evolution, and dynamics. This will focus either on the quiescent, slowly evolving streamer belt or on the rapidly varying active streamers. The investigation of the interrelation of solar wind acceleration region and magnetic topology of the flux tube guiding the expansion necessitates as well long-term observations. The opportunity to freeze a streamer section at the limb offers, in addition, the possibility of increasing dramatically the statistics, being, in this case, only limited by the intrinsic evolution of the structure and not by solar rotation. A significant increase in statistics is then coupled with the possibility of observing at high spatial resolution; this allows us to resolve the fine structure and relevant dynamics in the slow wind coronal source regions. This kind of studies requires the simultaneous knowledge of the electron density and morphology of the corona, by observations in visible light, and of the radial flow velocities, obtained with better accuracy and detail from images of the ultraviolet H I and He II emission, by Doppler dimming techniques.

High-latitude observations will greatly impact on the study of large-scale structures of the solar corona. If this phase occurs during solar minimum, from high latitudes the Orbiter views the streamer belt running at low-latitude, or close to the equator, as an approximately continuous annular structure around the solar disk. Furthermore, the out-of-ecliptic vantage point is indeed providing another means to observe the corona not affected by solar rotation. When the morphology is relatively simple and the relevant coronal features are at low-latitude, or close to the equator, their intrinsic evolution can indeed be easily separated from rotational effects if viewed from high-latitudes.

Another interesting aspect concerns the possibility to study the dynamics of coronal expansion all around the streamer belt. During solar minimum, slow solar wind studies would be privileged, since their supposed low-latitude and equatorial sources are predominant on the plane of the sky. It would then be possible to (i) assess the contribution to the slow wind of sporadic reconnection events, such as the coronal blowouts, and (ii) evaluate the total mass and magnetic flux injection into the heliosphere all along the streamer belt.

Therefore we have to:

- search for evidence of pseudo-streamers in the solar wind,
- study the detailed structure of the pseudo-streamers and
- study if slow wind is originating from pseudo-streamers.

Remarks:

- Noci & Gavryuseva (2007) observed a quiescent streamer at solar minimum with UVCS for 4 consecutive days and determined the velocity pattern in it. Several days should be enough, but several hours of observations could also give us useful insight.
- We should not observe at perihelion since we need METIS and a rather big FoV.
- A declining phase of the solar activity is preferred for a fully developed pseudo-streamer.
- Quadrature with Earth for combining with Solar Orbiter RS observations with L1 in situ, or Earth coronagraphs observations with Solar Orbiter in situ.

This objective is addressed by the SOOP L_FULL_HRES_HCAD_Coronal-Dynamics, which is aimed at observing structures in the outer corona and linking them to the heliosphere observed in situ. METIS and SPICE are leading this SOOP, while in situ payload provides continuous observations. Synoptic support from other remote sensing instruments is provided. Disk center pointing is preferred.