Solar eruptions (solar flares, coronal mass ejections (CMEs), filament eruptions, etc.) are different manifestations of a common physical process, i.e., reconfiguration of solar magnetic fields also known as magnetic reconnection. While they are primary drivers of space weather, predicting their timing and magnitude of impact on Earth's magnetosphere is highly unpredictable primarily due to ill-defined initiation conditions related to the source region properties and their evolution. Adding to this, understanding the physics of eruptive (with CME) vs confined (without CME) flares is a growing problem in the present solar physics. The standard solar flare energy release scheme (CSHKP model) supports us by explaining a majority of observations related to eruptive flares. However, it is crucial to include the three-dimensional perspective to the flare model to realistically support the multi-vantage point observations and sophisticated 3D numerical models, as planned in this proposal.

Solar cycle 24th (2009-2019) surprised us with the largest-of-the-cycle active-region which did not produce any CME, despite producing many very strong flares. Since confined flares are generally not geo-effective, these is a lack of statistical analysis of their properties, and a lack of studies of associated phenomena such as brightenings around the eruption, disturbances generated during their start, propagation and stopping, temperature distribution or the presence of non-thermal particles accelerated during the eruption stoppage. This limits our understanding of the processes that stops the eruptions. Understanding whether a flare is confined or eruptive or/and whether a filament eruption can be successful or failed is essential for the improvement of space weather forecasts.

Generally, hard X-ray (HXR) source location (e.g., above the X-point, above the loop top (Masuda type), thermal looptop, footpoint and halo (albedo), etc.) provide an excellent marker of magnetic reconnection region and can reliably support the inference of magnetic field configuration that took part in the eruption process. However, often some types of HXR sources with different morphologies and locations pose a challenge to be explained entirely with the help of the standard flare model. This can primarily be attributed to the fact that standard flare scenario is usually interpreted in a 2D geometry as the majority of observations are provided from Earth-orbiting lone experiments which observe 3D reality projected on the 2D plane of sky. However, the launch of the STIX imaging spectrometer onboard the European Space Agency's Solar Orbiter mission and the HXI X-ray imager onboard the Chinese ASO-S mission, offer a first-ever possibility for observing HXR sources from two vantage points, thus allowing a three-dimensional perspective of the source region of solar eruptions. Both the instruments are spectroscopic Fourier imagers with overlapping energy ranges in the 13-150 keV band. Starting from November 2022, many of interesting flares of solar cycle 25th were observed simultaneously by STIX and HXI. Therefore, this is the need of the hour to conduct statistical, sequential and exhaustive analysis of such a unique set of observations to perform 3D analyses. This offers a great opportunity to investigate the nature of confined and eruptive flares via investigation of the HXR source's 3D locations, time evolution, and spectral properties together with contrasting them to the standard flare model scenario.

In view of this, the present grant proposal aims to answer some long-standing problems in Solar physics. For example, it is foreseen to - **understand the mechanism responsible for stopping/changing the direction of solar eruptions, identify the importance of the coronal magnetic field overlying the eruption site, categorize the coronal HXR sources that may be typical for confined flares (with and without failed eruptions), and which are most common for successful eruptions, obtain the HXR sources' 3D locations in the solar corona, etc. This, in turn will allow comprehending the standard 2D flare model with the new stereoscopic observations, which has a potential of enhancing it universality.**

The proposal aims to obtain the answers to the above problems by analyzing a completely new set of data that which is now available to the solar physics community: common HXR spectra and imaging from two instruments observing the Sun from two vantage points i.e., STIX and HXI. In addition, expecting more interesting events shortly, we plan to add a third vantage point to HXI and STIX, which is provided by recently launched Indian Aditya-1 mission. The data from both X-rays spectrometers onboard Aditya-1 will be provided to us by PIs of instruments. The observatory is located at the L1 point between Earth and Sun. Based on STIX and HXI data, a recently published work led by the PI, may provide a proof-of-concept for this project where we have developed and tested the methodology for a single case analysis. **The conclusions identify the importance of a three-dimensional perspective and how 2D or single vantage point observations can easily mask the geometrical and energetic characterization of the flaring region, thus limiting our interpretation.** Therefore, in this grant proposal, we plan to use existing, well-understood and widely accepted tools to analyze a new generation of HXR observations from different vantage points in a statistical sense. The results of the proposed work are of key importance in understanding the fundamentals of solar flares. Moreover, it will trigger new collaborations between the Polish team and international partners which, we hope, will bring cooperation in building new space instrumentation dedicated to solving the vital problems of heliophysics. Our recent experience with the STIX experiment showed the value of such synergies. Poland has invested greatly in STIX since 2011, and this proposal will ensure that significant science return of STIX stays in Poland.