Solar flares and accompanying events are by far the most energetic dynamic phenomena in the Solar System emitting substantial amount of energy in the X-ray range. The release of energy from magnetic fields takes place high in the solar corona. Particles are accelerated there to very high energies which consumes almost 70% of energy released from coronal magnetic fields. Particles escaping from the acceleration region may reach interplanetary space where they are recorded as Solar Energetic Particles (SEP). Remaining particles propagate along closed magnetic structures to the chromosphere where they experience Coulomb collisions with ambient ions, and lose their energy. This causes abrupt heating of encountered plasma to temperatures above 10 MK. Plasma heated due to high energy particle beams fills coronal magnetic structures which is observed in the X-rays as flares.

Observations of active events in the solar corona and their influence on the state of the heliosphere are main aims for ESA's key solar mission: *Solar Orbiter* (SO) a part of the COSMIC VISION program. The mission was launched on Februrary 10^{th}, 2020. Observations conducted in the framework of this mission, which is equipped with 10 scientific instruments, will provide answers to the fundamental questions concerning solar physics, physics of the heliosphere and physics of the Solar System. For the first time observations of the Sun with high spatial resolution will be made from a distance as close as 0.3 AU. *In-situ* measurements of magnetic field variability and energetic particles populations will allow to study their relation with active phenomena and their influence on the heliosphere. This will be undertaken with unprecedented quality and accuracy. During a SO mission, for each of the many Venus's gravitational assist maneuvers, the orbiter will be transferred to the higher inclination orbit and higher ecliptic latitudes which will give better view of solar polar regions without geometrical distortions. Observing these regions is crucial for understanding of the solar dynamo mechanism and the small-scale active events occurring in polar regions which change their magnetic polarity every ~11 years.

Spectrometer Telescope for Imaging X-rays (STIX) is one of ten instruments on board SO. It will observe the Sun in the 4 - 150 keV energy range. At present there is no instrument observing the Sun in this energies. Images obtained by STIX will achieve spatial resolution of ~1000 km (on the Sun) thanks to approaching our Star as close as 0.3 AU. For hard X-ray imagers operating from Earth's orbit such spatial resolution is impossible to reach. STIX is an imager equipped with a coded aperture. It means that instead of ordinary mirrors, to reconstruct the image pairs of grids with various pitch distances are used. Grids from each pair are slightly tilted relative to each other which causes occurrence of Moiré pattern on the front part of a detector. This pattern is precisely measured thanks to pixelated Calliste-SO detectors. STIX is equipped with 30 such grid pairs which allows to reconstruct images with desired excellent spatial resolution.

STIX is a sophisticated instrument which will operate in open interplanetary space in a harsh thermal and radiation environment. It will experience impacts of coronal mass ejections and SEPs. Therefore, observational conditions will be highly variable which will demand precise planning of the observational modes. High energy particles cause undesirable effects in X-ray detectors, and they are a source of secondary X-ray radiation from orbiter constructional parts. We plan to analyse the data collected during the nominal scientific phase (2021-2025). We will test and optimize the image reconstruction algorithm MARLIN which we developed under previous NCN grant. Observations of small solar flares (microflares) will allow us for precise estimation of after-launch geometry of the instrument parts. The background caused by energetic particles will be investigated also. With all these activities we will improve scientific data analysis algorithms and use them for analysis of the data obtained during the rise phase and maximum of the next 25^{th} solar cycle. During that period we will deeply investigate solar flare footpoints in HXRs and EUVs. Moreover, we are going to investigate mysterious coronal X-ray sources which are still not well understood. One of the aim in this project is the analysis of chemical composition of different X-ray sources. In addition, in January 2022 the first China solar observatory (ASO-S) will be launched. The spacecraft will be also equipped with X-ray telescope the Hard X-ray Imager (HXI). We plan to perform stereoscopic observations of solar flares with a use of both European and Chinese instruments. This will be done for the first time in X-rays. The results of our investigations will be collected in the catalogue available online for everyone.

Polish scientists have been invited to the STIX consortium by Principal Investigator, initially prof. Arnold Benz from ETH Zurich (at present the PI of STIX is prof. Säm Krucker). Polish contribution (~20%) to the STIX project became crucial and critical for the success of the experiment. Experience already gathered and expected to be gathered following possible success of the present Project will result in the growth of Polish experimental astrophysics, and heliophysics in particular.