The goal of this project is to gain a deeper understanding of one of the most energetic phenomena in the Solar System — **solar flares**. A flare is a sudden release of a large amount of energy stored in the magnetic field, triggered by its rapid reorganization. During these events, enormous amounts of radiation are emitted across a wide range of wavelengths — from radio waves and visible light to high-energy X-rays and gamma rays.

During the **impulsive phase of a solar flare**, when the energy is released most violently, electrons are accelerated to very high velocities due to **magnetic reconnection** occurring in the **solar corona**. These electrons then travel along magnetic loops toward the lower layers of the solar atmosphere. Upon reaching the denser material in the **chromosphere**, they lose energy through Coulomb collisions, leading to the emission of **hard X-rays** (HXR). At the impact sites, the solar plasma is heated and emits thermal radiation in the **ultraviolet** (UV) and **extreme ultraviolet** (EUV) ranges. UV/EUV emission on the solar disk appears as elongated ribbons, whereas HXR sources are typically observed as compact, point-like structures — even though theoretical models predict both types of emission should exhibit similar morphology. It is important to note that X-ray images are not obtained directly — they are reconstructed from indirect measurements using specific computational algorithms. This raises a fundamental question: **do X-ray images truly reflect the physical nature of solar flares, or are they largely shaped by the technical limitations of the instruments used**?

The project involves a comparative analysis of X-ray data collected by the **STIX** instrument aboard the **Solar Orbiter** spacecraft and ultraviolet observations from the **AIA** instrument on the **Solar Dynamics Observatory** satellite. The main objective is to improve our understanding of the energy deposition process in the solar atmosphere by electrons during the impulsive phase of a flare. We aim to enhance the resolution of STIX X-ray images to obtain more detailed spatial maps of **flare footpoints** — regions where the magnetic field is anchored in the chromosphere. To achieve this, we will develop the existing **MARLIN** algorithm for X-ray image reconstruction and apply machine learning techniques to estimate reconstruction uncertainties and reduce imaging artifacts. By creating a tool capable of producing STIX images with the highest achievable resolution, we will be able to perform a detailed analysis of the spatial relationships between HXR and UV/EUV emissions. The collected observations will serve as a foundation for building theoretical models of solar flares that reproduce the energy distribution along magnetic structures — from the reconnection site in the corona down to the solar surface. The expected outcome of the project is not only a deeper understanding of solar flare physics but also the development and open dissemination of advanced X-ray data analysis tools for the scientific community.