## Overview, Goal, and Objectives

Our goal is to analyze one sunspot as a group in terms of Frequency, Power, and the comparison between the two. Findings of our group will be compared with the data from other groups. This research will help us understand how often our sun releases flares at each energy level. With this understanding of sunspots we will be able to better predict trends in both occurrence and energy of sunspots as well as compare sunspots on our sun to those on other celestial stars.

## Background and Significance

Past research has studied sunspots within a vast energy range, from about 10^24 to 10^38 ergs, leaving some spots unfilled. Our goal is to fill in some of those holes at energy values of approx. 10^32 and 10^26 ergs. The past research that has been done is essentially the same as ours, looking at the relation between flare energy and frequency. This research has shown that there is an inverse relationship between the two; as flare energy increases, frequency decreases. There have also been previous determination of alpha (***α***), which is the value for the change in energy over time.

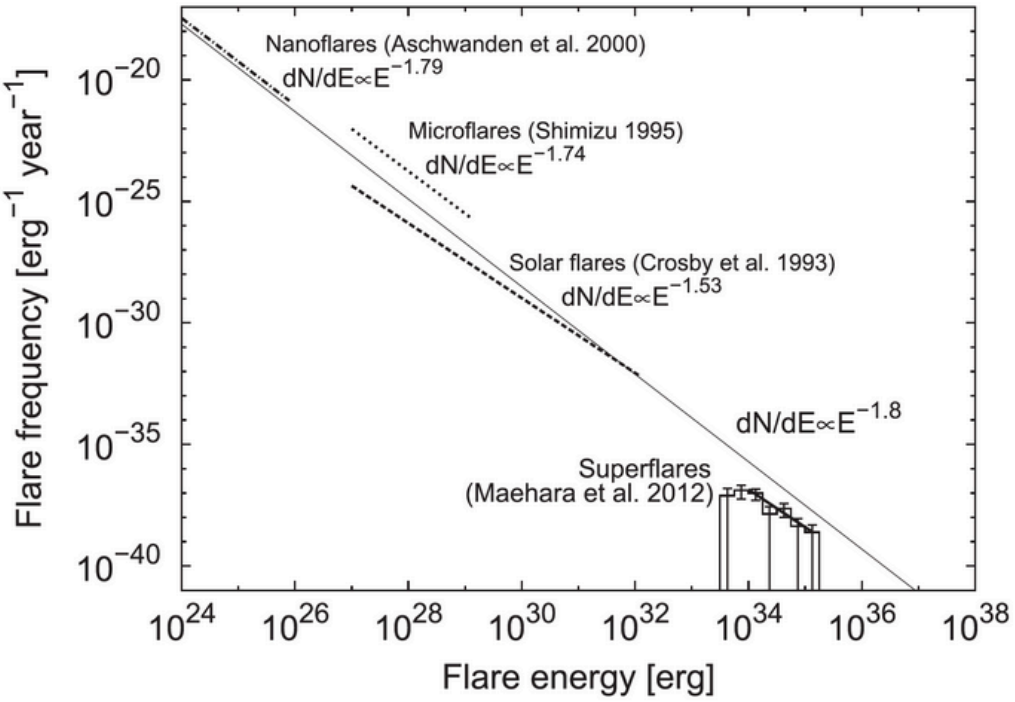
## Analysis Plan

Our group will download longwave data (W/m^2) for a specific solar flare from the GOES-15 satellite and use our skills developed from the coding packet to convert longwave to the unit ergs (ergs/m^2) and mathematically analyze this data and produce graphical representations of it. This graphical representation will allow us to integrate the area under the curve to calculate the total power of the sunspot. By plotting the data with a logarithmic scale and fitting a power law to the graph we will also be able to calculate alpha which represents the change in energy overtime. To assist us with these calculations and data plotting, we will import python libraries “numpy,” “pandas”, and “matplotlib.pyplot.” Possible errors in our modeling could come from incomplete data that comes from when the earth is blocking the satellite from receiving x-rays from the sun. We can minimize this uncertainty by estimating the amount of energy emitted during these gaps. Another source of error can come from the consolidation of the data from other groups. This can come from inconsistencies in data processing. By peer reviewing other groups' work we can help minimize errors.

## Broader Impacts

Our research will help provide accurate predictions for solar flares (frequency and energy) that will aid in preparation for high energy flares. This can help anticipate geomagnetic storms and damage to satellites as well as help collect data for development of technology in communications and power grid equipment which provides resilience to outages and damage due to solar flares. Data will aid in satellite prepositioning due to prediction of solar flares. As a group we will develop teamwork, coding, and scientific research skills in upcoming physicists and scientists as well as potential interest in continuation of this research.

## 2. Sketches (limited to 2 pages)




Shows the past data found by different research teams on the relationship between flare energy and flare frequency.


An example of flare energy recorded by the GOES-15.