The main objective of our experiment was to try to answer the following questions:

- Does the activity of the Sun influence the variation of these values?
- Does the value of the magnetic field vary depending on the face of the Earth, whether it is day or night?

To carry out this research, we first developed a code in the python language that allowed us to take the data that seemed appropriate to answer the questions posed. Our experiment consisted of taking data on temperature, acceleration and magnetic fields in the ISS for three hours on April 4th, 2019 from 16:08:44 until 19:06:24. We represented the data and then we analyzed if there was some important difference and we identified if it was related to solar activity. We also represent the images taken through our experiment on the trajectory of the ISS to reinforce this scientific project.

**Method**

We have done the data processing with the Anaconda Jupyter platform and the Python programming language. In this way we have been developing the whole study, analyzing the data, mainly the values of the magnetic field, its graphs and identifying if with these values we could answer the questions that we had initially considered. With the data obtained with our experiment (temp_h, accel_x, accel_y, accel_z, mag_x, mag_y, mag_z), we calculate the total magnitudes of magnetic field and acceleration. Likewise, we calculate the position of the ISS (latitude and longitude) corresponding to each measurement taken and identify when it was eclipsed and when it was in the day zone.

The next step was to represent the variables and perform a first analysis of the graphs (Figure 1). When representing the different magnitudes, on the one hand we studied if the magnitudes varied with respect to the position of the eclipsed or not eclipsed ISS and on the other hand we analyzed the behavior of the total magnetic field. We were struck by the discontinuity presented by the magnetic field at three points (Figure 2) and proceeded to study them. We identify the positions of these points in order to identify them on Earth. We looked for the geomagnetic observatories closest to these points (BEL, MCQ and CKI) in [www.Intermagnet.org](http://www.Intermagnet.org) and checked if there had been variation in the Earth's magnetic field on the date our data was taken. In this way we were able to discover that the magnetic
field at those points had intensified on that date, as our experiment on board the ISS had detected. To know what the origin of this variation had been, we studied the solar radial velocity graphs and the magnetic field components in the Sun on April 4th, 2019 at www.solarmonitor.org, and compared them with other days close to April 4th. In this way, we detected a magnetic perturbation due to a current coming from a coronal hole, which was detected by the ISS when passing through the electrojet north and south.

**Figure 1.** Magnetic field, Acceleration and Temperature

**Figure 2.** Magnetic field

**Results**

In the analysis of the temperature data taken with the experiment, we represent the values to check if the behavior of the temperature changed depending on whether the ISS was eclipsed or not. Although the temperature change detected is very low, when analyzing the graph it seems that in the day zone, the temperature increases slightly and when it becomes eclipsed it decreases (Figure 3). The temperature values obtained are within the range of 32 to 33.7 degrees. This temperature seemed higher than expected (27 degrees approximately). Perhaps this increase in temperature may be due to the arrival of the Progress M-11 cargo capsule at 16:22 on April 4th, 2019.

**Figure 3.** Temperature
On the other hand, when studying the trajectory of the ISS and the values of the magnetic field (Figure 4), it can be verified that the magnetic field is increasing in the day zone and begins to decrease when entering the eclipsed zone. We also represent the trajectory of the ISS, the day and night zones and the values of the magnetic field, it could be observed that it not only varies between eclipsed and non-eclipsed zones but also that it is greater when it is near the North Pole and smaller when it is in the South Pole except in the points that present a discontinuity (red point) that its values are higher (Figure 5).

Finally, we focus on explaining the peaks in the values of the magnetic field. Once located in the trajectory of the ISS, we look for the geomagnetic observatories closest to these positions ([www.Intermagnet.org](http://www.Intermagnet.org)). We found the first peak in the South Pacific (MCQ), the second in Poland (BEL) and the third and less pronounced near Singapore (CKI). Effectively on April 4th, 2019 these observatories also detected a variation in the earth's magnetic field. We studied the possibility of whether this variation was related to the solar activity of this day. In order to do this, we investigated if there had been any change in the radial velocity of the sun and in the components of the solar magnetic field (Bx, By, Bz) on that same day. Thanks to the information provided by [www.SolarMonitor.org](http://www.SolarMonitor.org) we compared these values from April 1st to April 6th, 2019. We find that on April 4th and 5th, 2019, the radial speed had reached values around 550 km/s and it is usually around 400 km/s, and also that the components of the magnetic field had undergone changes and had been identified (Figure 7). Investigating the activity of the Sun in those days, these variations were due to the existence of a coronal hole (Figure 6), whose current produced a magnetic perturbation that the ISS detected when passing through the north and south auroral electrojet, corresponding to the passage through Poland and the South Pacific (red point figure 5).
We also represent the images taken through our experiment on the trajectory of the ISS (Figure 8).

**Conclusion**

Regarding the temperature, it increases slightly in the non-eclipsed area. The values are abnormally high, perhaps due to the coincidence of the arrival of the Progress M-11 cargo capsule at that moment.

With the analysis of the magnetic field we reach the following conclusions:

- It is cyclical, increasing in the non-eclipsed area and decreasing when entering the eclipsed.
- The value is greater when it is near the North Pole and lower when it is in the South Pole except for the three peaks that have a discontinuity that have higher values.
- The first peak (discontinuity) is in the South Pacific (MCQ), the second in Poland (BEL) and the third and less pronounced near Singapore (CKI).
- The geomagnetic observatories near these areas detected such variations by that date.
- We found that on April 4th and 5th, 2019, the radial speed had reached values around 550 km / s and that the components of the magnetic field had also undergone changes.
- The variations were due to the existence of a coronal hole, whose current produced a magnetic disturbance that the ISS detected when passing through the northern and southern auroral electrojet, which corresponds to the passage through Poland and the South Pacific.

As a conclusion, we can say that the value of the magnetic field of the ISS varies according to the face of the Earth, depending on whether it is in the eclipsed area or not and that it can also be affected by solar activity. Answering these questions, we consider that we have achieved the objective of our experiment.

Finally, thanks to this project we have had the opportunity to carry out a scientific work, becoming researchers, with real data, answers to our initial questions and formulation of new unknowns. We discovered that the main path of study led us to new questions, which increased our curiosity and interest in science.

We attach two links where you can see the study made with the data. On the one hand there are the longitude and latitude calculation of the ISS and on the other hand the graphs and data obtained in this scientific work:

**Graphics and data:**
[https://drive.google.com/file/d/1kALw9xENK2a4S3a1uJkcnVkqlg-9_wx7/view?usp=sharing](https://drive.google.com/file/d/1kALw9xENK2a4S3a1uJkcnVkqlg-9_wx7)

**Longitude and Latitude:**
[https://drive.google.com/open?id=1kALw9xENK2a4S3a1uJkcnVkqlg-9_wx7](https://drive.google.com/open?id=1kALw9xENK2a4S3a1uJkcnVkqlg-9_wx7)