From stardust we come, to stardust we shall return

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Abstract

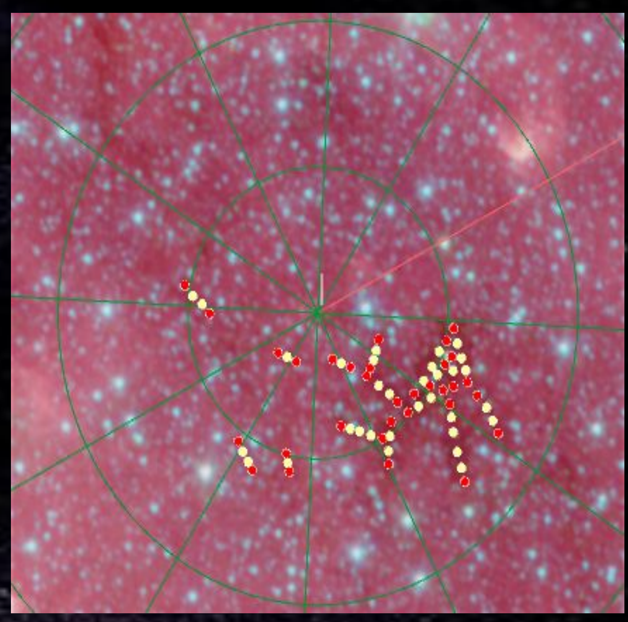
In this project we have studied two stages of the life cycles of stars. In our first task we studied the first stage, when interstellar molecular clouds become dense and heat up thanks to molecular friction. Here we studied photos of gas clouds for dark filaments who's coordinates we then reported in a google sheet. In the second task we studied protostars that were in the second stage of the cycle. Here we recieved pictures of high-mass protostars. We were to count the amount of stars around the high mass protostar and report them in the google sheet. Just to get an understanding of how far away our objects where. The gas clouds we two studied were 16,633.0 lightyears away, and the protostars 17,938.0 lightyears away. Lastly we started the porster-work, where we would summarize and explain what we had done and learned under the course of the project. Now the question is, why? We see it as that this project has been so that we students can get a glimpse of how research is conducted and how it works in the real world of science with a connection to the Nobel prize.

Background

This year's project has been given the name "The Star Hunt". Under this project we have worked based on different hypotheses that the scientists have been giving to us. First it was the hypothesis that the dark filaments in the first task are mainly pointed along the angle of the milky way. Last but not least, there also were two different hypotheses about the second task. The two hypotheses were that lighter protostars hoop around heavier protostars and that they mostly hoop around the poles.

The question now is, what do the scientists get out of this? Thanks to this project the scientists get an opportunity to test their hypotheses with the help of all the students data. By analyzing the data they then get answers on for example, how the filaments in the first task is pointed along the milky way. The data from the first task also help the scientists how many filaments there are in special dense molecular clouds and how big the filaments can be. As you can see the data is very helpful for the scientists and we students got to do important and big work that the scientists otherwise had to do.

In our opinion this project also has been formed to help us students. We have both got to see and learn more about the process behind real scientific research. We have also got the opportunity to learn more about scientific texts and specially english scientific texts, as they aren't in our native language.



The picture we analyzed in task one.

What have we done?

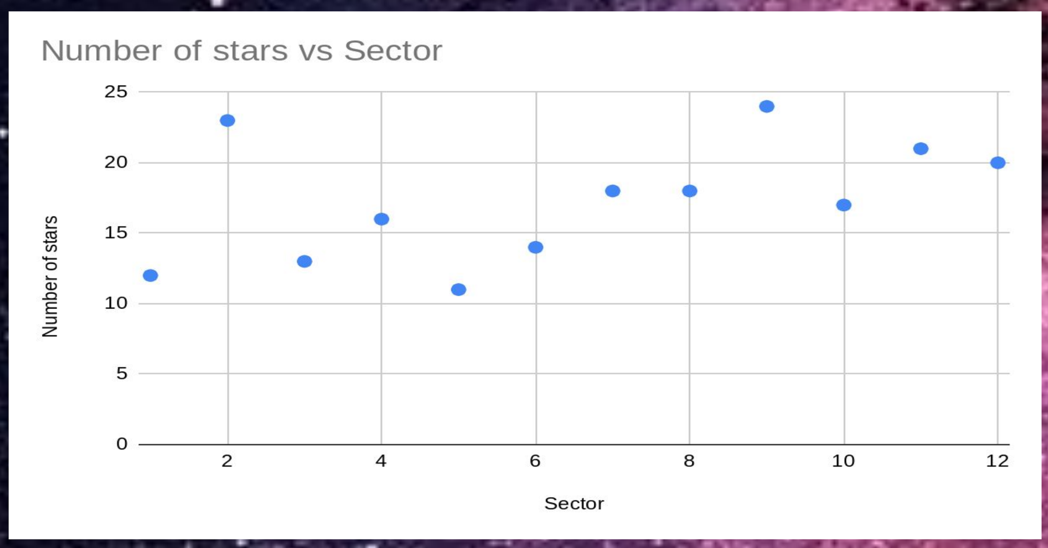
First of all, we watched an introductory video of our first task. Here the scientists explained what we were going to do and why. We then started the project by receiving pictures taken in infrared light by the telescope "Spitzer". The pictures from "Spitzer" were located in the program "World wide Telescope". "WorldWide Telescope is an web or app based simulation of the night sky from a telescopes point of view. These were pictures of different interstellar molecular clouds.

We were then put into groups, each with it's own picture. We got cloud G28.67+00.13 which is 16,633.0 light-years away. Our mission was to search in these pictures for dark formations which we would hope to be dense molecule filaments. When then marked these dark formations and put these coordinates in a google sheet that also had been assigned to us. This google sheet already had premade formulas that would calculate the data for us, we just had to insert the numbers. With the data we gave, the sheet calculated for ex. angle of the galactic plane. With another formula we then counted the filaments with the same angle of the galactic plane and reported them in a smaller separate chart.

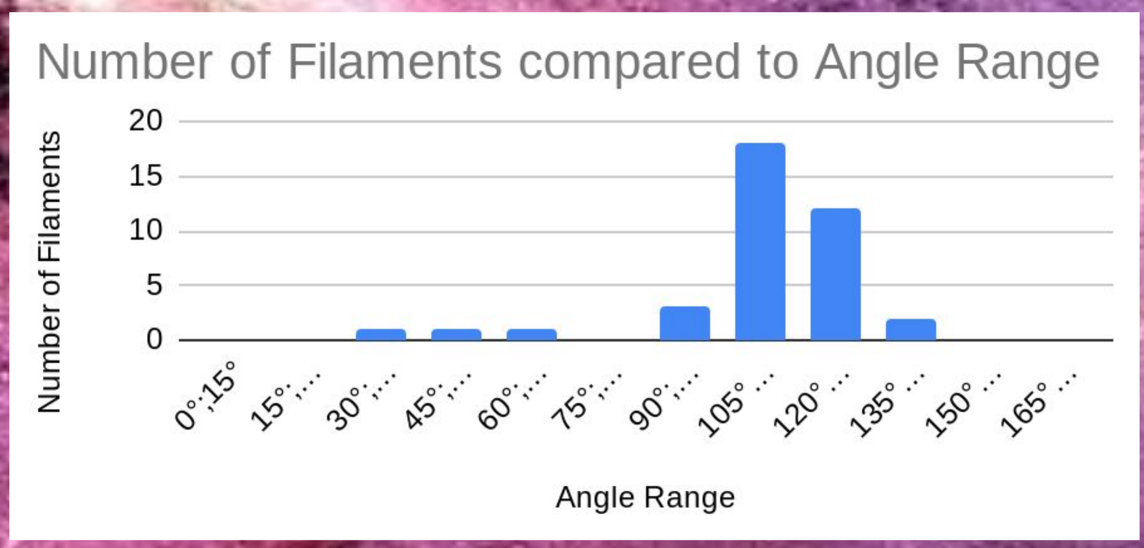
When we had done our first task it was time for our second one. Now we were going to be analyzing more pictures, but this time the pictures were of high-mass protostars. Protostars are stars that are newly born in an astronomical view which means a couple of 100 000 years, and are still gathering mass. We got a star with the name G309.92, which is 17938 light-years away. This time we were going to count the stars around the high-mass one. For this we used the so-called "bullseye" which is a measuring-tool in World Wide Telescope, to count in both the sectors and circles around it. We then once again inserted the raw data into the sheet so that it could work it and give us the processed data the scientists needed.

Lastly we also did one of the side tasks, were we would make a scatter plot showing the margin of error for our calculations of the stellar volume density (Cubic Light-years (ly^3)).

The picture we analyzed in task two.
The sectors go counter clockwise.



The number of stars in each sector of the bullseye we talked about in the results.



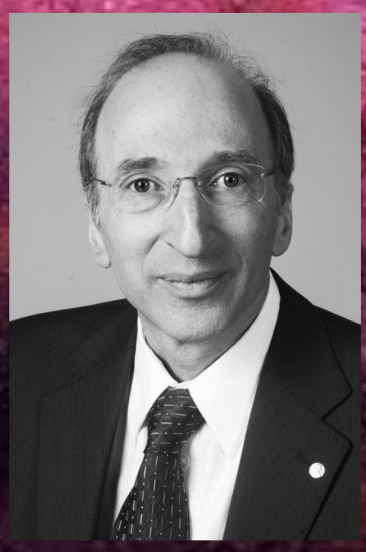
Number of dark filaments with the same angle to the galactic plane from the results.

The results

From the data we recieved from our first exercise, we concluded that the majority of our filaments had an angle around 105° - 135°, with most of them laying between 105° - 120° compared to the galactic plane. Since the galactic plane is at 180° and 0° (since they are the same but facing different directions) that makes the scientists almost right. This also considering that none of our filaments were closer than 37.5°. Our filaments are more diagonal to the galactic plane then aligned with the galactic plane. So the hypothesis about the dark filaments alignment to the galactic plane was not right about our filaments.

Regarding the other two hypotheses; the second hypothesis is right, but we are a bit thoughtful of the third one. The density of stars is clearly higher the closer to the high-mass protostar you come, which in our case proves the first hypothesis is right. But concerning the third hypothesis, we are not so quite sure. According to our data there are two sectors that have a higher density of stars, but these sectors aren't fully aligned. To be more precise, sector two and nine have the highest amount of stars. Thanks to this non-alignment we are not really certain if these points could be the protostars poles or not.

The scatterplot showed as we guessed, that as the circlesize increased and the amount of stars increased, the margin of error decreased starting at about a 1.5^{ly3} margin of error, and ending at about a 0.01^{ly3} margin of error.

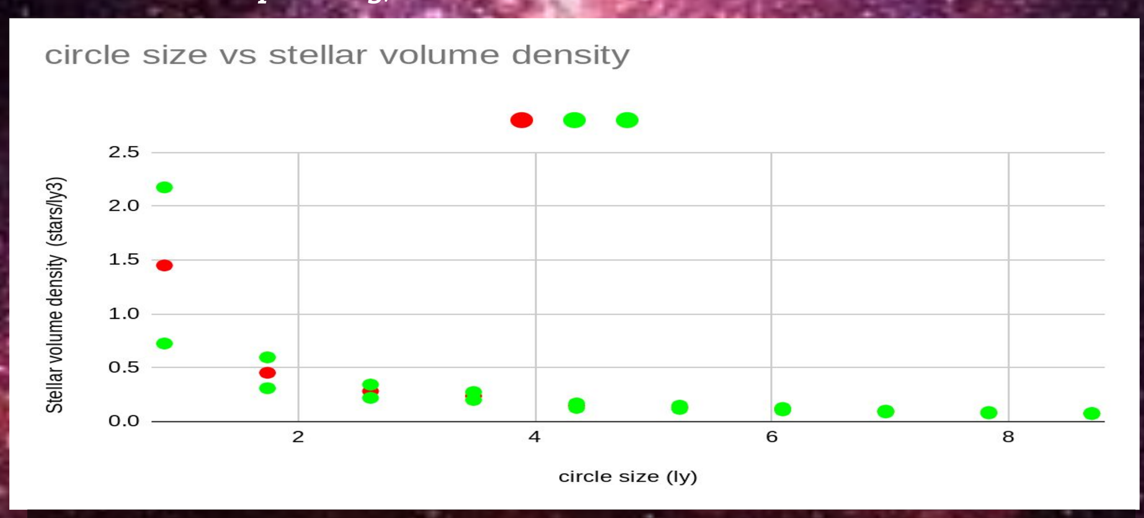


Saul Perlmutter

Brian P. Schmidt

Adam G. Reiss

Bildkälla: Nobelprize.org, © The Nobel Foundation. Photo: U. Montan



The scatter plot showing margin of error which we mentioned in the result.
The green dots shows both the error up and down.

Related Nobelprize

In this project all students who participated got to choose to learn a little more about a nobel prize related to the project. The one that we chose was the nobel prize in physics 2011. The nobel prize in physics 2011 went to Saul Perlmutter, Brian P. Schmidt och Adam G. Reiss, who discovered that the universe's expansion is accelerating. This was a surprising discovery as the world of scientists thought that the expansion of the universe after the big bang was decelerating or in other words, slowing down.

The winners came from two different teams competing to get their discovery first. Perlmutter from one, and Schmidt and Reiss from the other. They were measuring the deceleration of the universe by observing the most distant supernovae they could find and the redshift their light would experience on the way here.

Redshift is the phenomenon in which the frequency of light gets drawn out thanks to the expansion of the universe which makes the light have a lower frequency when it reaches its target which results in that objects really far away in space seem redder than they actually are.

Under the course of their project they thought that the amount of redshift would very slowly decrease, but to their surprize it actually increased. As with many other big discoveries, the goal was finding something else or in this case, the opposite.

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