

Randall Harper Research Award

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It is known that stars form from the gravitational collapse of cold gas within galaxies, but how this gas forms remains a debate. Our research involved the study of HISA cloud composition to better understand stellar evolution. HISA stands for Hydrogen I Self Absorption, and they form when cold neutral hydrogen blocks radiation from a warmer object. Since cold gas can collapse easier than warm gas, HISA features are what we chose to focus on in our research. However, to truly understand how HISA features play a role in star formation, we need to look at the composition of the cloud.

We are creating a new technique that allows us to derive column densities of different elements within the feature. My job is to test this new method with our data and compare our values to other research done in the same area of the sky. The testing of this method is as follows. First, using research from Sato (1990) and Hasegawa et al. (1983), I had to find regions of On, Near-Off, and Far-Off positions. An On position is the area that a HISA cloud occupies. Near-Off are positions close to the feature, but not in the feature. Far-Off are positions away from the feature. The idea with these positions is that the further away you go, the less elements of the feature will be present. These positions were used throughout the research to find values for column densities of specific elements. The Off positions were found by finding regions where there was no HI and CO.

Once the positions were found, I was then tasked with finding the parameters of the HISA features. Some of these parameters include column densities for different elements, the volume density of hydrogen within the feature, and the spin temperature of the feature. However, an interesting dilemma came up when finding these values. Due to how the math is established, the change of a single constant can impact our results. So, before I was able to start finding HISA cloud properties, I needed to know what this value might be. Unfortunately, there is no research article that states a definite value. This meant that I oversaw finding a constant that best worked for our features. To do this, I placed this constant into the math and documented how the feature changed with this constant. Luckily for me, there are certain values that give impossible results. So, I found the minimum value for this constant, and used that to derive the cloud parameters. We would then check this value with the research paper over the same features. This comparison is important as it allows us to refine our method. As of now, the process of refining this method is still in progress.

Once this method is established, I can begin finding cloud properties of any HISA feature. This tool would be incredibly important, as being able to deduce the parameters of a feature quickly would allow us to study more HISA features in given time. Which would allow us to create a better understanding for how these clouds form and how they play a role in stellar evolution.