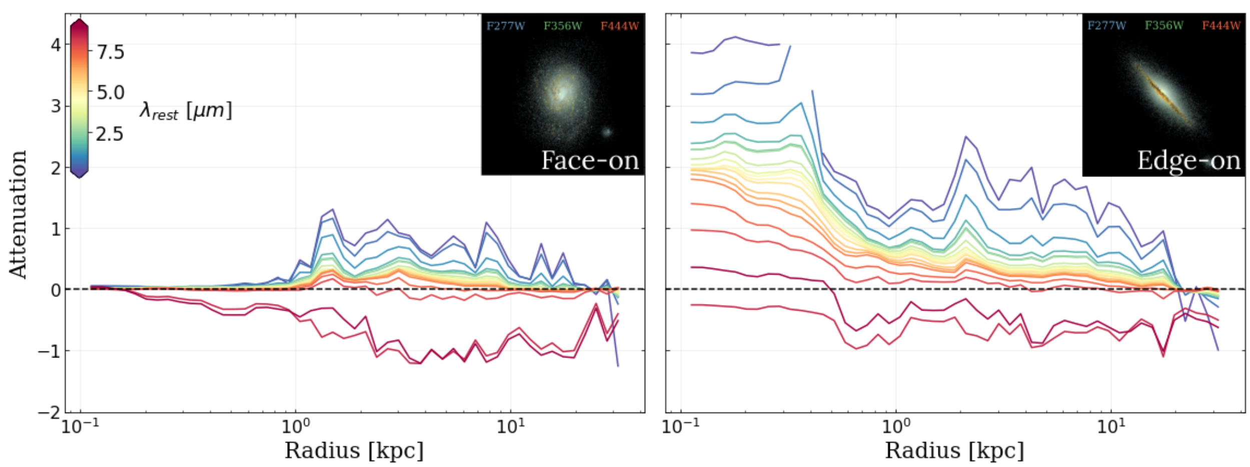
Throughout the summer, I worked under the supervision of Dr. Lamiya Mowla in the field of galaxy evolution. More particularly, I focused on trying to understand the effects that dust and dust distribution can have on how we perceive the size evolution of SIMBA simulated galaxies (Dave et al, 2019). The motivation behind the project comes from the difficulty of directly studying galaxy evolution through observation and our desire to better interpret what we actually see in the universe. For this purpose, simulations have become a very powerful tool in this field, but even though they help us get past that time scale barrier, they come with their own challenges. One of the challenges we wanted to address was that when we are comparing the measurements we make through simulations to those of observations, we are really comparing two fundamentally different things. One way that we have tried to close that gap is by including dust and using the Powderday dust radiative transfer package (Narayanan et al, 2020) to create mock observations of our simulated galaxies.

With the data we had available, we were able to look at the spatial distribution of light at 20 different wavelengths. First, we measured the integrated attenuation for a series of galaxies across redshifts 4, 2, 1, and 0.5. We found that there was a lot of attenuation happening at the UV wavelengths and some at the shorter optical wavelengths at all redshifts. We also saw a lot of that light being re-emitted by the dust in the infrared regime. By creating 2D attenuation maps, we measured the spatially resolved attenuation curve for galaxies at these 4 redshifts. We found that these measurements showed some interesting variations as a function of the distance from the center of the galaxy, especially for differently oriented galaxies. Finally, we created a pipeline that extracted the light-weighted and mass-weighted sizes of almost 600 mock observations of SIMBA simulated galaxies, spread over 4 redshifts. We used these measurements to look for trends in the ratio of light to mass weighted sizes over time.

The results we have found are exciting and still require further analysis. With the measurements we have so far made, we can look at the data using different mass bins, redshifts, star formation cuts, and observation angles. In this way, we plan to look for possible evolutionary trends in both the spatially resolved attenuation curves, and in the ratio of the light to mass weighted sizes at different wavelengths. From these results, we can also look for trends that can be used as corrections by observers when trying to predict the stellar sizes of galaxies from their observed light distribution at different wavelengths. These results are timely, as we look forward to the launch and consequent science that will be done by the James Webb Space Telescope, primarily in the infrared, where observations will be most certainly affected by dust.



Spatially resolved attenuation for a galaxy at z = 1 measured at multiple wavelengths. The left panel shows the attenuation for the galaxy observed face-on. The right panel shows the attenuation for the galaxy edge-on, where dust attenuation is more pronounced. In the panels we also show mock observations of the same galaxy as observed by the James Webb Space Telescope created by Dr. Lamiya Mowla using the Powderday radiative transfer package.