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Research Statement

I am a sixth year astronomy Ph.D. candidate at Columbia University graduating in 2019. I am interested in studying the formation and evolution of the Milky Way using ultraviolet measurements obtained by the Galaxy Evolution Explorer (GALEX). The Galactic plane had scarcely been observed with GALEX due to restrictions set to protect the detectors but these limits were lifted in its final years and data of the Galactic plane were taken. My team, including David Schiminovich of Columbia University and Dun Wang and David Hogg of New York University, used these data to complete the Ultraviolet Galactic Plane Survey (UVGAPS). UVGAPS has resulted in a high resolution map of the Galactic plane in NUV, with both a larger footprint and higher resolution than previous UV surveys in the same region. I specifically worked on the image source extraction and catalog creation of over 3 million objects, most of which have never been observed in NUV before. There is considerable overlap between UVGAPS and other optical surveys in the same footprint. Gaia DR2 has an 80% match rate while the match with Pan-STARRS DR1 yields about 40%.

Using the UVGAPS and Gaia DR2 cross match I was able to extract a large amount of white dwarf stars in the Galactic plane. Previous work used the GALEX All-Sky Imaging Survey (GAIS) to observe the distribution of white dwarf stars and measure their luminosity function. While SDSS has studied white dwarfs in the Milky Way extensively, their high Galactic latitude coverage probes a population that extends off the plane. The thin disk coverage and the large footprint of UVGAPS could add to our understanding of white dwarfs in the Galaxy and is an area that I want to continue to work on post-PhD.

With the large footprint and high resolution of UVGAPS I am able to observe distinct collections of dust clouds that compare well to surveys of molecular clouds in the plane. One project I would like to undertake during a postdoc would be to create extinction maps of these regions, especially those that are missing from the Pan-STARRS 3D dust map by Green et al. (2018), where UVGAPS has extensive coverage in the southern Celestial sphere. I can combine these maps with distances from Gaia to create a dust distribution and compare it to the 3D dust map.

While the UVGAPS pipeline was being produced, I studied the population of red clump stars within the existing GAIS. Using Gaia and The APO Galactic Evolution Experiment (APOGEE), I obtained spectroscopy for around 5000 red clump stars and discovered a distinct relation between NUV–Gaia G color and [Fe/H]. This result means we can now obtain photometric metallicities for red clump stars in GALEX and Gaia with only slightly larger uncertainties than metallicities obtained spectroscopically. If I extend this to red giant branch stars and to the coverage of UVGAPS we can create a unique UV-optical metallicity map of the Milky Way.