A Swift Search for Stellar Birth: Using Spectral Decomposition of Interacting Galaxies to Probe New Star Formation with Swift UVOT Observations

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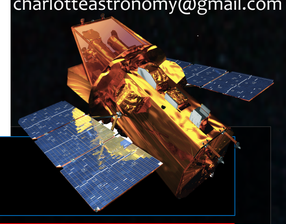


Motivation

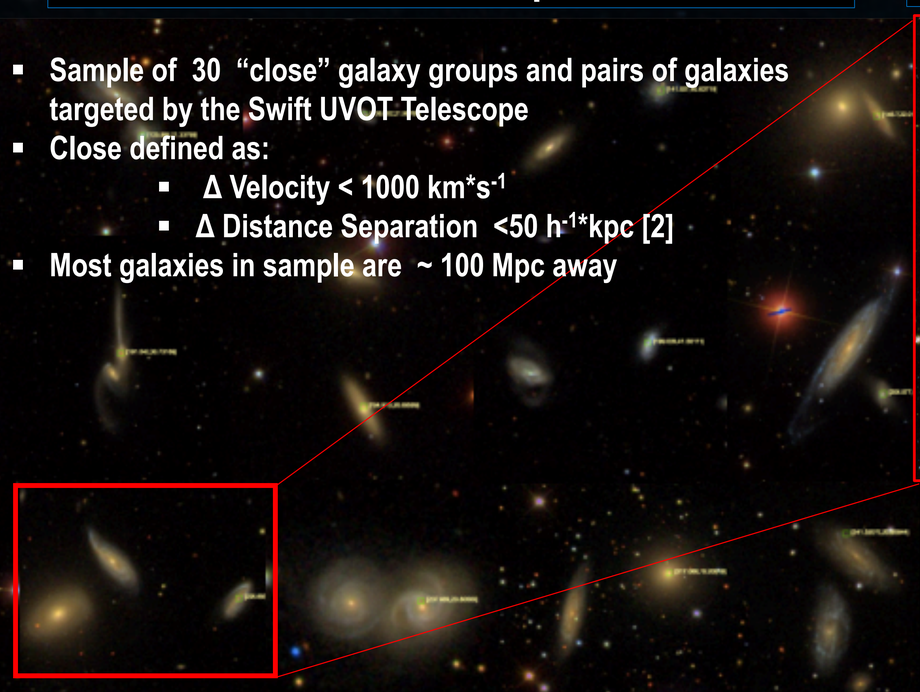
Galaxy interactions are key to understanding **stellar formation**, **galaxy evolution**, and the evolution of the **structure of our universe**.

The study of interacting galaxies have evidence of enhanced star formation[1], but …

- **How often do interactions trigger vs. quench star formation?**
- **Where and when does star formation occur?**
- **How does a new star formation event relate to other interaction properties (i.e. mass ratio, interaction geometry, distance and velocity separation)?**

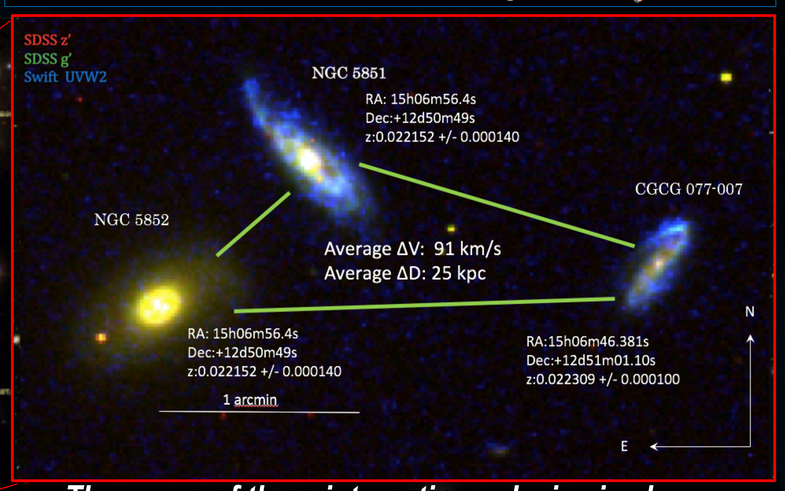
The Sample

- **Sample of 30 "close" galaxy groups and pairs of galaxies targeted by the Swift UVOT Telescope**
- **Close defined as:**
  - **Δ Velocity < 1000 km*s^{-1}**
  - **Δ Distance Separation <50 h^{-1}*kpc [2]**
- **Most galaxies in sample are ~ 100 Mpc away**



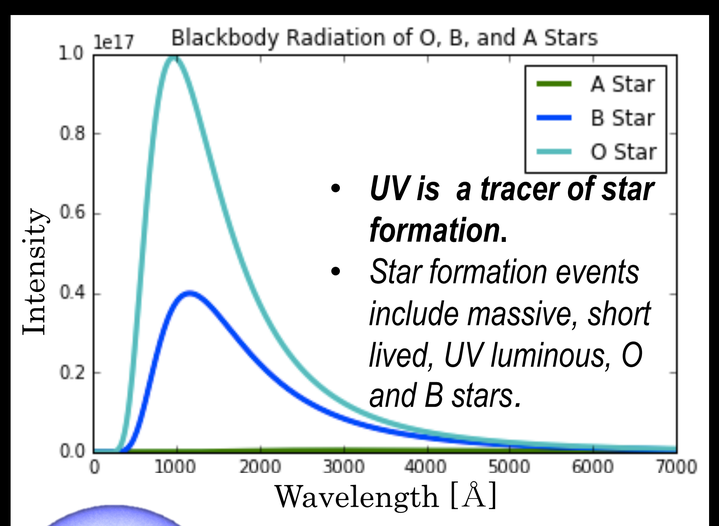
Images from SSDSS object explorer

Pilot Group

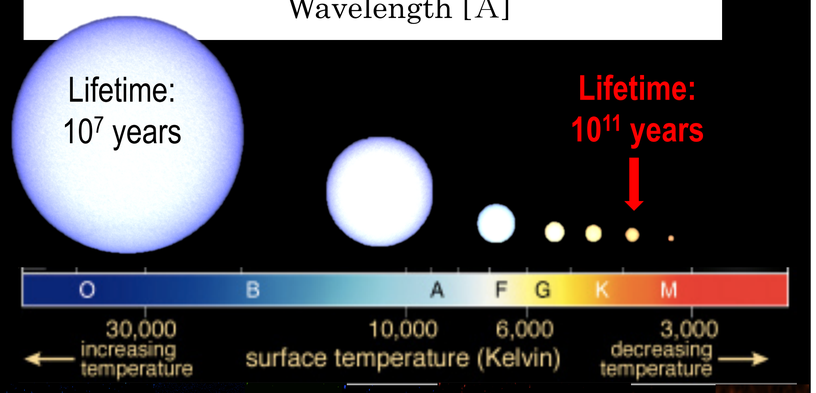


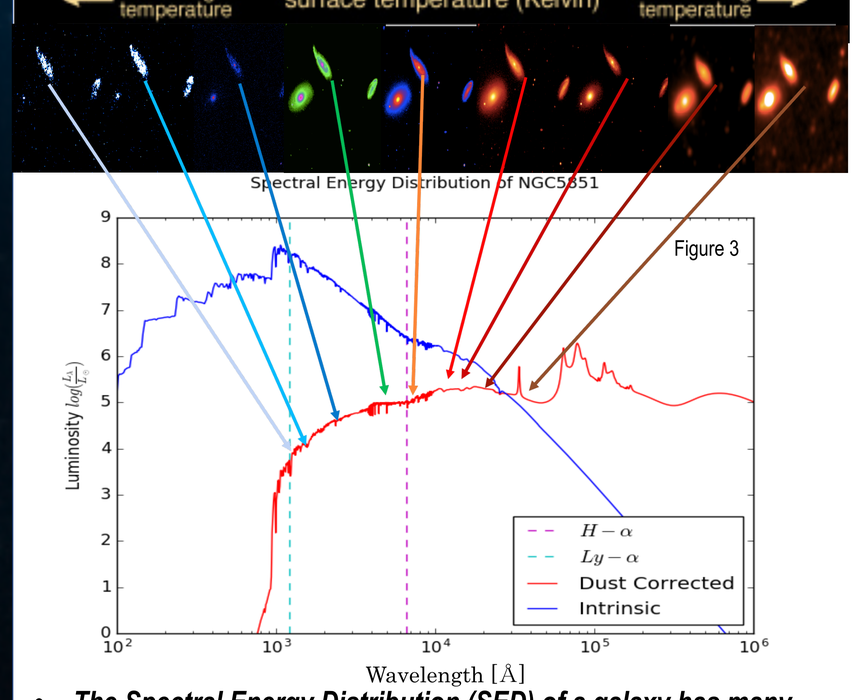
- ***The group of three interacting galaxies is chosen for the following reasons:***
  - Includes two active star forming galaxies and quiescent NGC 5852
  - Signs of possible tidal disruption in the arms of both NGC 5851 and CGCG 077-007
  - Distance and Velocity separation well within constraints
  - Redshift near average of parent sample

UV Traces Star Formation



- ***UV is a tracer of star formation.***
- *Star formation events include massive, short lived, UV luminous, O and B stars.*

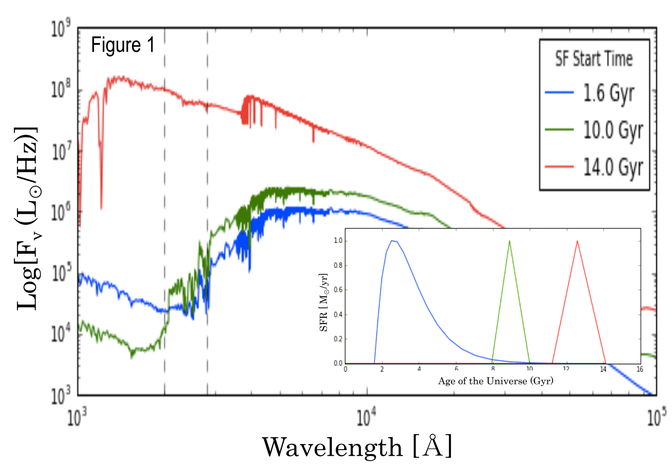


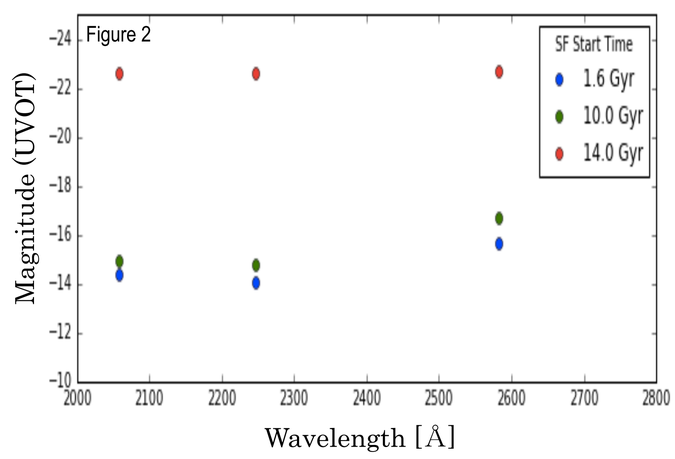


- ***The Spectral Energy Distribution (SED) of a galaxy has many ingredients other than UV***
- *UV light is absorbed by **dust** and re-emitted in the IR.[1]*
- *Observations in the IR help to constrain dust.[4]*

- **UV magnitude can vary widely depending on many related factors**
- Stellar populations redden as OB stars die
- UV wavelengths are sensitive to attenuation from metallicity and dust [1]

Synthesized Stellar Population with Delayed Star Formation History and UVOT Filters





- **Figure 1 [Top]:** Shows a stellar population simulated with FSPS. The spectra an SED of an **underlying** stellar population with a **recent** and an **older** burst. The inset shows star formation rates over time. The dashed lines show the range of effective wavelengths of the UVOT filters and an inset of . [3]
- **Figure 2 [Bottom]:** Shows the magnitude of the UVOT filters over the six parameters [3]

Methods

- ***Photometry of a fixed aperture is performed over observations from GALEX, Swift UVOT, SDSS, WISE, & 2MASS***
- Fluxes/Magnitudes for each band are then used to model an SED for the galaxy with a set of assumed priors (see Figure 2)
- We use best fit models of each to find the average age of the underlying stellar continuum (see Figure 1)

Future Work

- **Finding Regions of Star Formation:**
  Using the best fit model for the underlying stellar continuum we will convolve with filters for UVOT and SDSS to find the approximate scalings for image subtraction
- Our pilot study inform the method we will apply to the entire sample of 30 UVOT targets in order to look for relations between recent star formation and other properties.

References and Acknowledgements

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