Multiwavelength analysis of galaxies in Bootes Void

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Introduction

- Cosmic voids occupy 77% of the cosmic volume and it represents $\sim$ 15% of the total mass content implying that average density of void is around 20% of the average cosmic density[1].
- R. Kirshener[2] in 1981 discovered a large under dense volume at $(\alpha, \delta) = (222.50°, +46°)$, and cz_{mean} = 15,500 km s^{-1} spanning a diameter of 42 Mpc with redshift range 12000 km s^{-1} < cz < 18000 km s^{-1}.
- Voids provide pristine environment for secular evolution of galaxies. Studying void galaxies may unearth key features of primitive galaxy formation scenario of the universe.
- We aim to study the influence of environment on galaxy evolution by examining properties such as Far-UV (FUV) emission, and UV and optical colors of galaxies.

Observations

Observations of Bootes void were taken using *ASTROSAT/UVIT* in both BaF2 (λ_{eff} = 1541 Å) and Silica1 (λ_{eff} = 2418 Å) filters of *UVIT*.

PI: Kanak Saha
Observation ID: G07_077T01_9000001306

Complementary imaging of *UVIT* region is obtained from various independent observations including *SDSS u,g,r,i,z* and *2MASS J,H,Ks*.

Methodology

3 σ source catalog were created.

Completeness magnitude limit for FUV/NUV: 24.0/25.5 mag

Kron photometric technique were adopted for photometry.

Source classification of stars and galaxies were done using various color-color diagrams.

Galaxies in Bootes Void

Two galaxy members of Bootes Void having z_{spec} and nine tentative members of void with z_{photo} identified.
Cone diagram to shows redshift distribution of galaxies in the direction of Bootes void. Red circles represent the boundary of Bootes void.

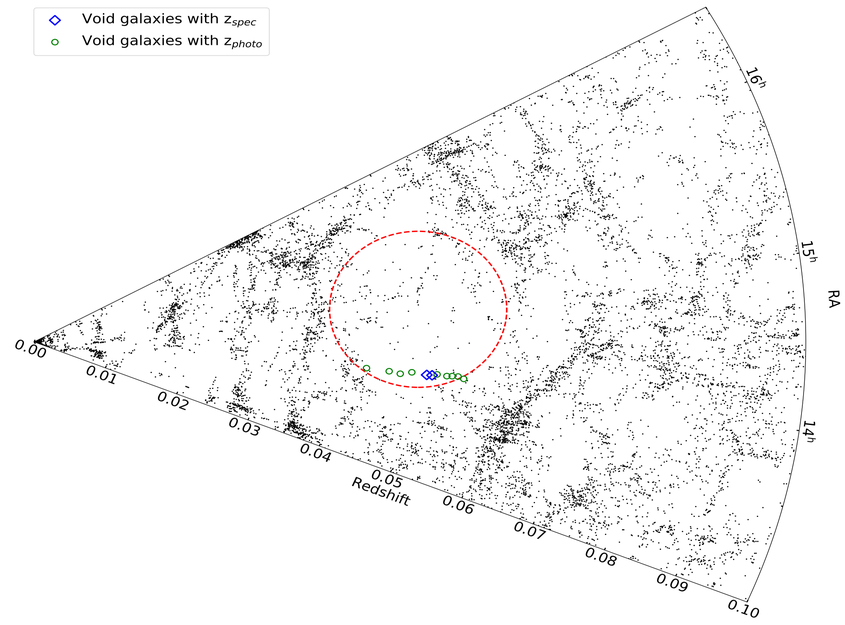
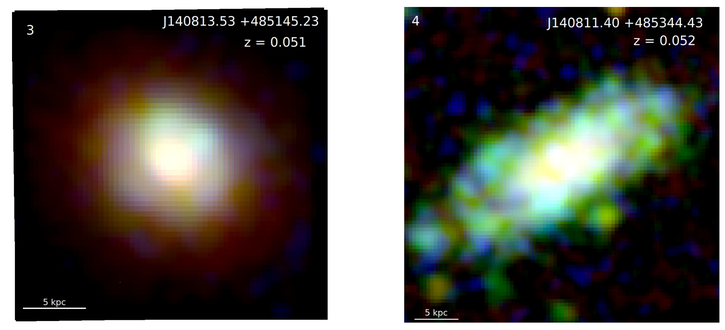
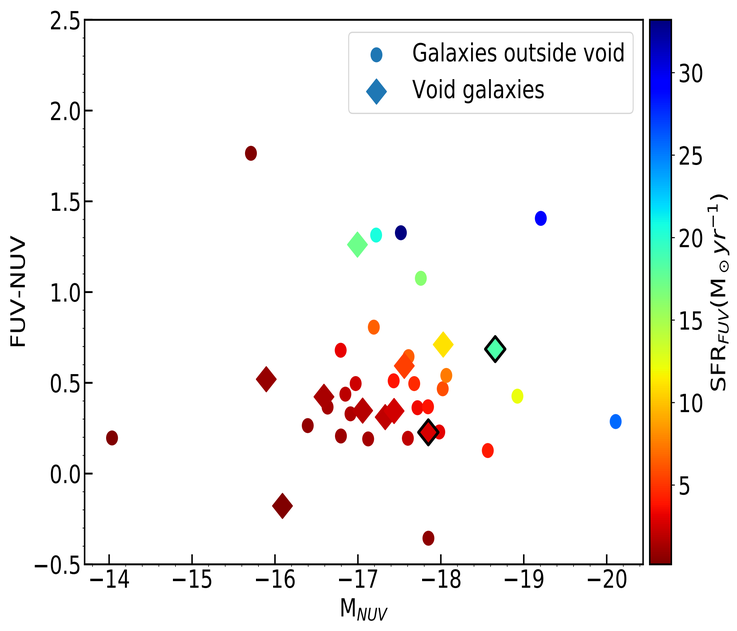


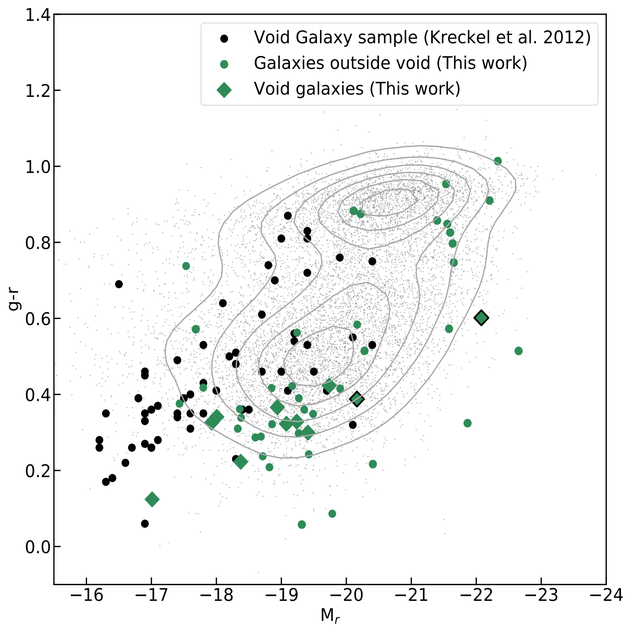
Figure shows RGB(Red: SDSS r-filter, Green: UVIT NUV filter, Blue: UVIT FUV filter) composite images of spectroscopic void galaxies.
Visual classification shows discy and spiral morphology, respectively.



Color Magnitude Diagrams



- UV colors for our sample implies that void galaxies are star forming and late type.
- We observe that most of void galaxies detected have moderate $SFR_{FUV} \sim 3\ M_\odot\ yr^{-1}$. SFRs for void galaxies are higher than SFRs of normal spiral galaxies or dwarf galaxies.



- Most of the void galaxies belongs to the blue cloud population implying ongoing active star formation with late type morphology.
- Void galaxies are less luminous than non-void galaxies.
- Massive green valley galaxy have been detected in the sample. ($M_* = 8.6 \times 10^{10} M_\odot$)

Conclusions and Future Work

1. Void galaxies have moderate SFR_{FUV} comparable to non-void galaxies.
2. $(FUV - NUV)_0$ and $(g - r)_0$ show similar results i.e., void galaxies are blue in color, late type with fainter luminosities.
3. Passive green valley void galaxy have been detected in our FOV. Given the isolation of the galaxy, mass quenching would likely be the driver of transition in this case.
4. Structural properties of void galaxies would be examined further.
5. Comparative study of evolution and star formation history of galaxies based on their environment would be done.

Reference

[1] Marius Cautun et al. "Evolution of the cosmic web". In: *Monthly Notices of the Royal Astronomical Society* 441.4 (May 2014), pp. 2923–2973.

[2] R. P. Kirshner et al. "A million cubic megaparsec void in Bootes". In: *ApJ Letter* 248 (Sept. 1981), pp. L57–L60.