Rare Signals from Stars in the Triangulum Galaxy

Olivia P. Gaunt

Broad Emission-Lined Luminous Sources (BELLS) detected in stellar disk of M33

01

Background

Context on our data, M33, and Wolf-Rayet stars

02

Observations

Presentation of BELLS spectra, and time comparison

03

Conclusions

Our findings, implications thus far, and future direction

01 Background

Our data, M33, and WR stars

Keck II: DEep Imaging Multi-Object Spectrograph (DEIMOS)

https://keckobservatory.org/media/maunakea-summit/

The Triangulum Galaxy (M33)

- 2.73 million light-years from Earth (that's relatively close!)
- Estimated 40 billion stars
- In the Triangulum constellation
- Barred spiral morphology
- Actively star forming

Image Credit: ESO

Wolf-Rayet Stars

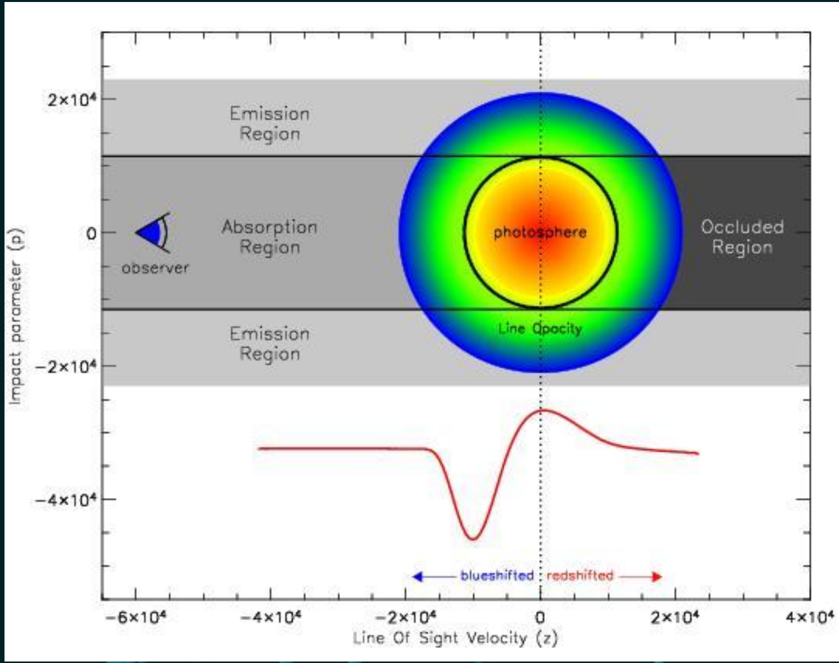
- Rare class of emission line stars
- O-type star → WR star → Type Ibc supernova
- Strong stellar winds and high mass loss rates
- Characterized by expanding bubble of ionized gas

ESA/Webb

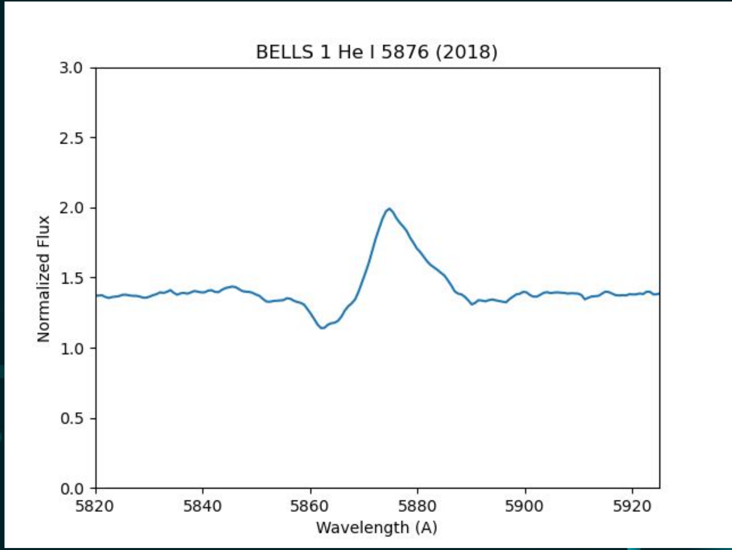
02 Observations

BELLS spectra, and time comparison (2018 - 2022)

P-Cygni Profiles



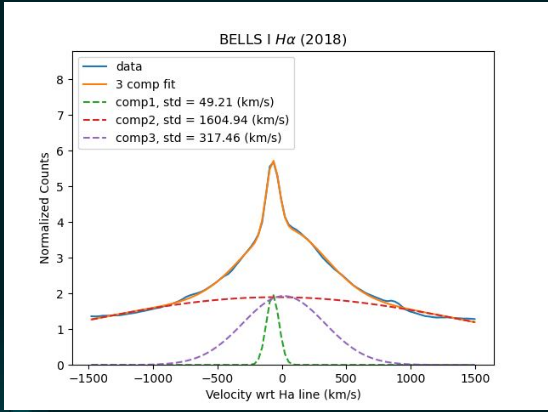
BELLS 1

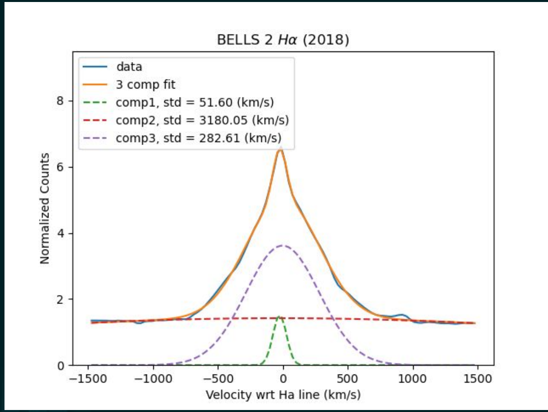


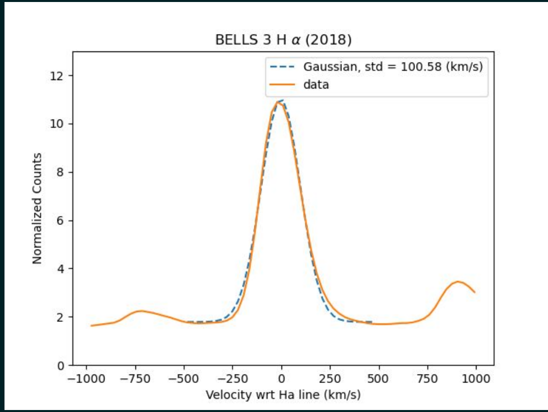
Broad Emission

Broad emission is another common spectral feature of the BELLS. H-alpha emission is shown as an example below.

Note: BELLS 3 is the only object in our sample that does not show broad H-alpha emission–but it does show many other BELLS characteristics!



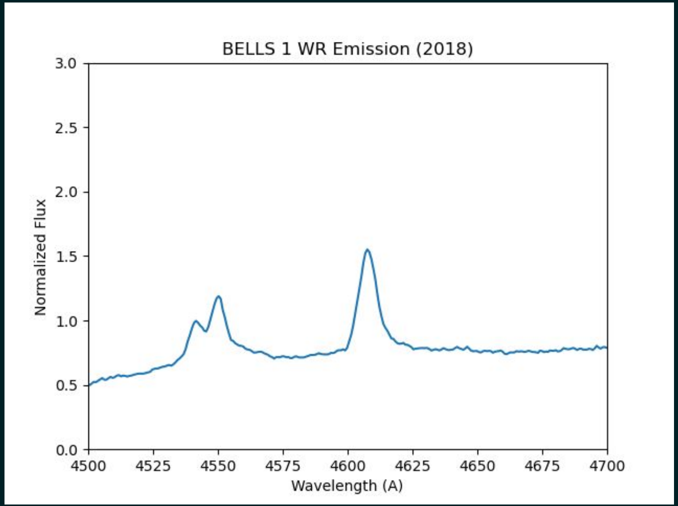


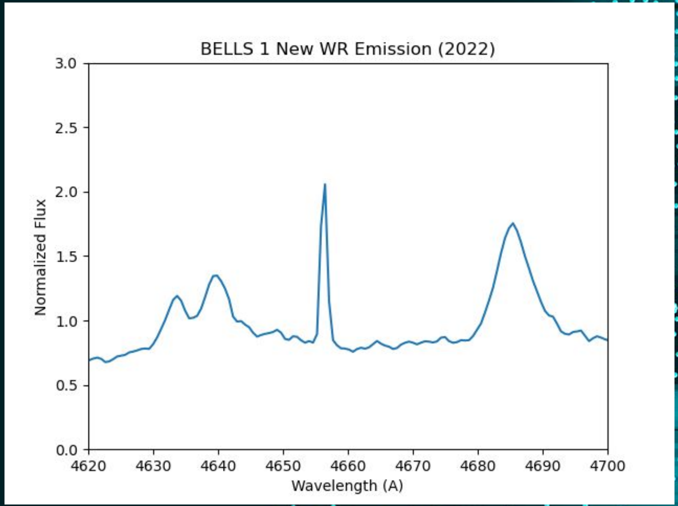


New WR Emission

In one object (BELLS 1), we see something very exciting:
New Wolf-Rayet emission!

The 2018 spectrum shows three emission lines associated with Wolf-Rayet stars. The 2022 spectrum shows four!





03 | Conclusions

Findings, implications, and future study

First Observation of WR Evolution

- We saw **new Wolf-Rayet emission on a 4-year timescale** in one of our BELLS–we do not believe this has been seen before

- Several of these objects have been previously categorized as an even more rare class of WR stars, which are **in transition from O-type to WR**

- We can also **track changes** in other spectral features (strength, width, shape, doppler shift, etc.)

Future Work

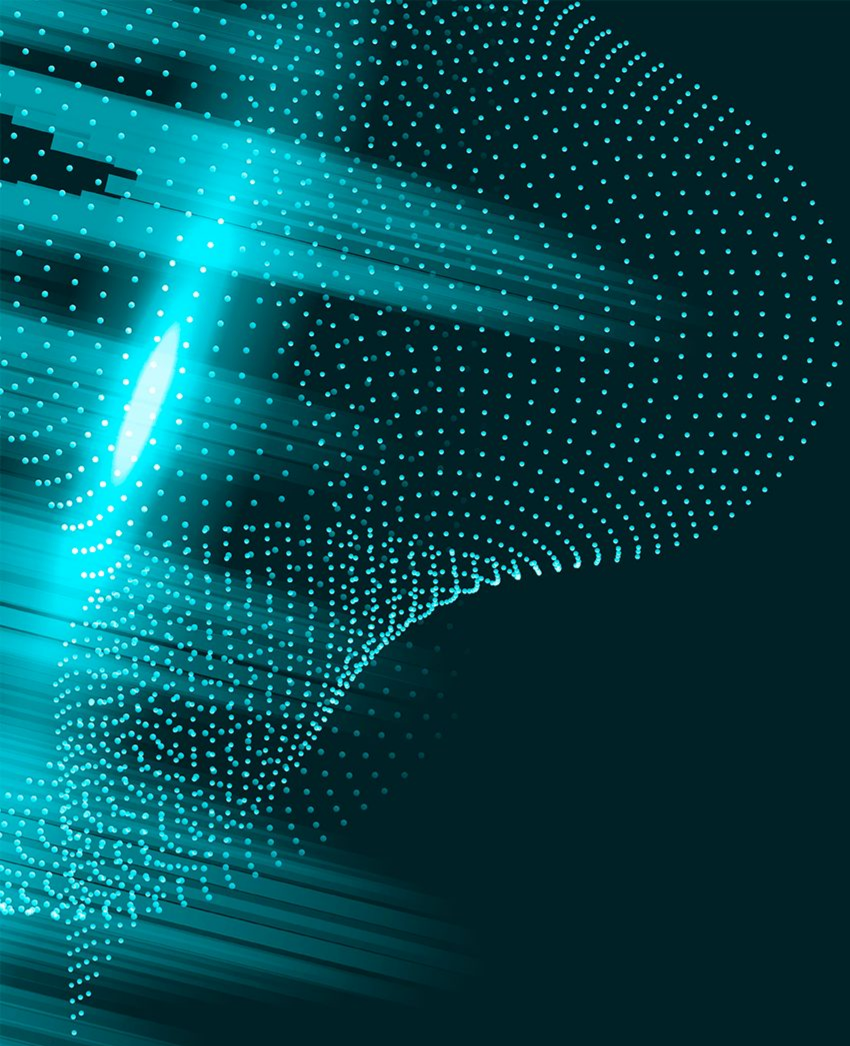
Track Changes and Confirm Classifications

We will continue monitoring these stars as concurrent observing runs allow. We hope understand how WR stars change, and how quickly.

We also hope to confirm detections of WR stars, as well as their previous classifications

Understanding WR Infrared Emission

Our data spans longer wavelengths than many existing WR studies. We hope to understand the emission of WR stars in the infrared, and track their evolution over time.



Thank You!

Olivia Gaunt, Tufts University, Medford, MA
Email: olivia.gaunt@tufts.edu

Citations

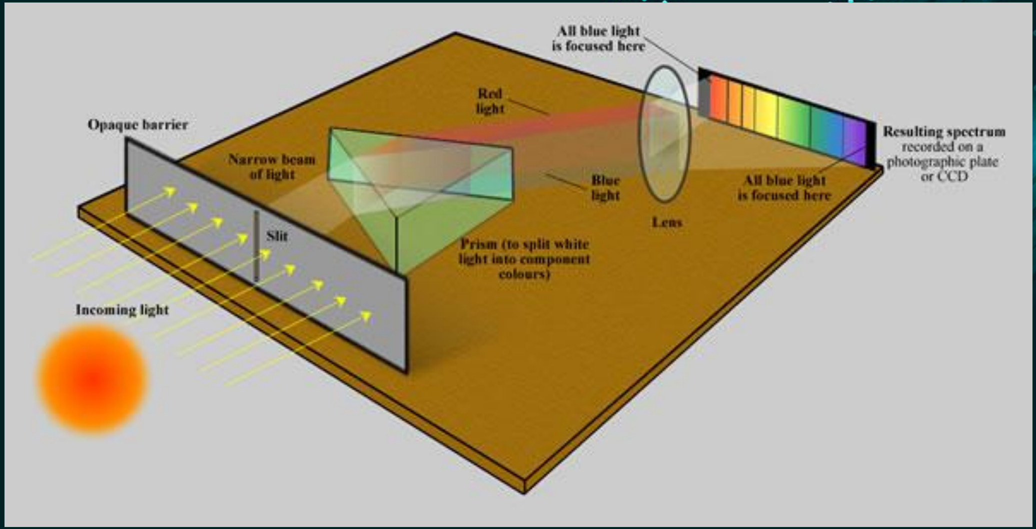
Massey & Johnson (1998), ApJ 505 793
doi:10.1086/306199

Neugent & Massey (2011), ApJ 733 123
doi:10.1088/0004-637X/733/2/123

Massey et al.(1996), ApJ 469 629 doi:10.1086/177811

Spectroscopy in Astronomy

- Spectroscopy measures the strength of light at each wavelength
- Emission or absorption at specific wavelengths can inform our understanding of physical processes at play
- Most stars show absorption lines, but there are special classes of emission line stars



https://astronomy.swin.edu.au/cosmos/s/Spectroscopy