

Thuto Ndlovu<sup>1,2,3</sup>, Itumeleng Monageng<sup>4,5</sup>

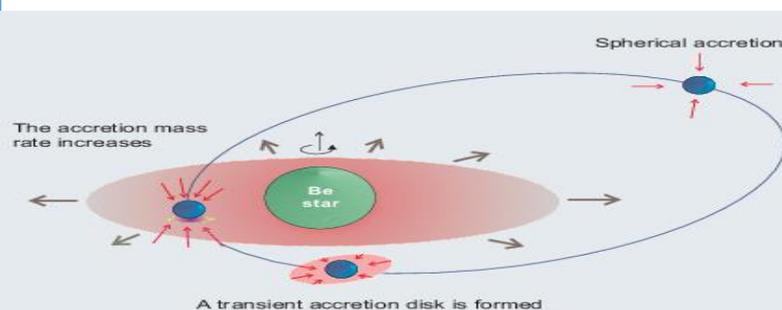
1. Department of Science and Innovation, 2. South African Radio Astronomy Observatory, 3. University of KwaZulu-Natal, 4. University of Cape Town, 5. South African Astronomical Observatory

## Abstract

- We perform a systematic study of circumstellar discs of Be/X-ray binaries to demonstrate observational signatures of the Kozai-Lidov mechanism.
- We analyze the double-peaked H-alpha emission line of the data collected from the Liverpool Telescope.
- This will be done together with the analysis of X-ray light curve from the Rossi X-ray Timing Explorer All-Sky monitor.
- The Be/X-ray binary star of interest is 4U 0115+64.

## Introduction & Background

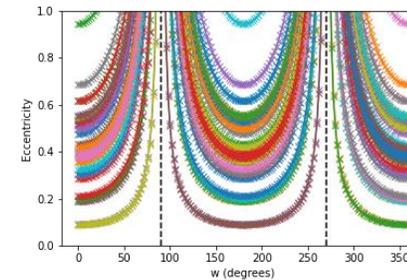
- Be/X-ray binaries are a class of high mass X-ray binary that consist of a neutron star eccentric orbit around a massive B spectral type star.
- The complex interaction of the neutron star with the material in the circumstellar disc around the Be star, results in transient X-ray activity.
- The transient X-ray activity have two types of X-ray outbursts: Type I outburst & Type II outburst.



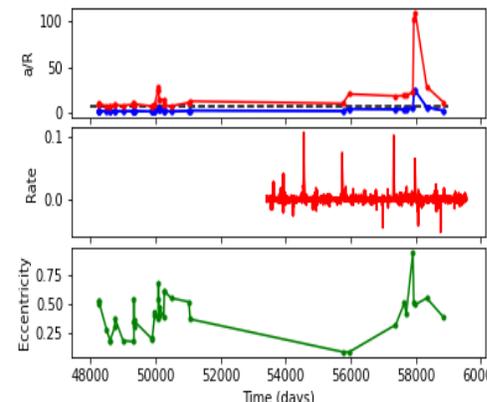
## Results

- The result below show the eccentricity as a function of argument of periastris.
- The  $e_{\max}=0.93$  &  $e_{\min}=0.1$  at  $\omega=0^\circ$ ,  $\omega=180^\circ$ ,  $\omega=360^\circ$ .
- This confirm that the disk of the Be star is elliptical shape.

$$e_p = \frac{v_{red} + v_{blue}}{v_{red} - v_{blue}} \sec w$$



- The X-ray light curve from the Rossi X-ray Timing Explorer All-Sky monitor is shown in the middle.

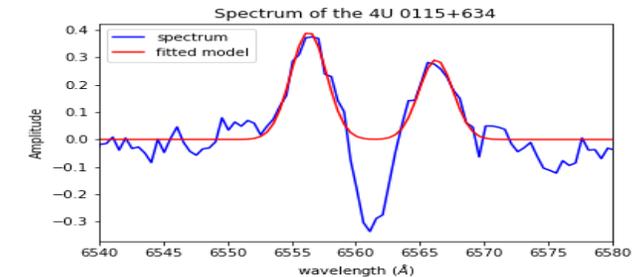


$$\frac{a_p}{R_1} = \left( \frac{2v_{crit}}{v_{red} - v_{blue}} \right)^2 \frac{\sin^2 i}{1 - e_p^2}$$

- The semi-major axis and the eccentricity of the disk is very high during 57900-58200 days and passes the periastron passage.

## Method

- The optical data was obtained from the Liverpool Telescope.
- The software used is IRAF which is a software system for the reduction and analysis of astronomical data.
- The files were downloaded as Flexible Image Transport System (FITS) files.
- The Two Gaussian fitting from Python was used to fit a double peaked spectrum.



## Summary Conclusion

- The results show that circumstellar discs undergo morphological variability which influences the mass accretion onto the neutron star.
- The Type II outburst has shown up on the higher eccentricities and semi-major axis.
- 4U 0115+64 undergo Type II outburst for all  $i \geq 20$ .

## Future Possibilities

- Analyse a sample of Be/X-ray binary stars.
- Follow up on the Be/X-ray binaries in the southern hemisphere with SALT.