Study Of The Flux Emitted From The Outer Surface Of The Stars Aldebaran, Fomalhaut And Rigel Observed From Nagarkot Observatory, Nagarkot, Nepal

Kapil Ghimire, Karan Bhatta, Udayaraj Khanal, Prem Raj Dhungel, Saroj Shahi

Abstract: We present a study on the relative flux density emitted from the outer surface of the stars Aldebaran and Fomalhaut as observed from the Nagarkot Observatory, Nepal on the 24th of November 2016. We found that the variation of the relative flux density of the stars were found to be symmetrical in nature going from the outer surface of the star to the interior of the star and finally to the outer surface of the star again through the diameters. The flux was found to be minimum at the outer surface reaching to its maximum in the interior of the star and finally to its minimum value at the outermost surface of the star. The values of the relative flux density were found to be minimum for Rigel and maximum for Aldebaran. There was a slight anomaly detected in the relative flux density of Fomalhaut which may have been due to the debris of dust that surrounds the star.

Index Terms: Aldebaran, relative flux density, Fomalhaut, Rigel, Nagarkot observatory

1 INTRODUCTION

Fomalhaut (α Pisces Austrinus) and Aldebaran (α Tauri) are two very bright stars that are visible from the northern hemisphere[1], [2]. Aldebaran has been extensively studied in order to calculate various parameters such as its size (diameter), radial velocity variability, detection of oscillations or running waves, fast photometry occultation, and periodic nature [3], [4], [5], [6], [7], [8], [9], [10], [11], [12], [13], [14], [15]. Similarly study of Fomalhaut has revealed debris dust emission in interferometric, millimeter and sub-millimeter range and its coronagraphic images observations at solar system scales have been carried out [16], [17], [18], [19], [20], [21], [22], [23], [24], [25], [26], [27], [28]. Rigel, one of the brightest stars in the sky, has revealed inhomogeneous circumstellar envelope among other properties [29],[30], [31], [32], [33], [34], [35], [36]. We simply present a study on the flux emitted from the outer surface of the star which was observed through Nagarkot Observatory, Nepal on the 24th of November 2016.

OBSERVATION

The observation was carried out on the 24th of November 2016 from the Nagarkot Observatory, Nagarkot, Nepal from the 16 inch Meade LX200GPS telescope. The GPS tracker equipped MEADE LX200GPS telescope tracks a star not through the GPS because of the metal dome that prevents the GPS tracking but from Autostar which tracks a specified star from the vast library of stars that are pre-installed in the software.

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METHODOLOGY

We obtained FITS images of the stars from the Nagarkot Observatory. The co-ordinate system used was J2000. We drew isocontours along the FITS image. We then drew 8 diameters along each image and analyzed the flux along these diameters. We took various points outside the outermost contour and took an average of these points. Since the flux along these points was present even in the absence of a star, the average of these points acted out as the background flux that can act as our standard error. We did this for the three stars in consideration. We subtracted the average value of the background flux densities along each pixel from the flux densities along the pixels and plotted these values for all the stars at once to look for irregularities in the relative flux densities.

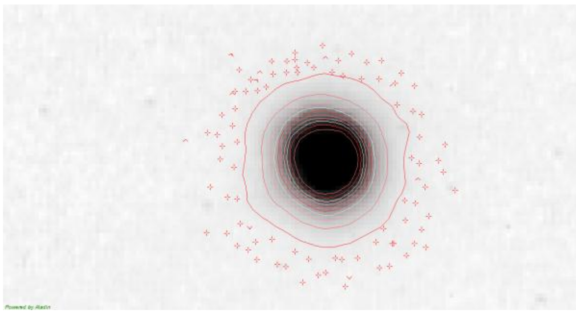

Fig1: *isocontours along Aldebaran and average flux of the points outside the outermost contour gives us the background count*

RESULTS AND DISCUSSIONS

Flux Density Variation in Aldebaran

The ten isocontours along Aldebaran is shown in figure 2.

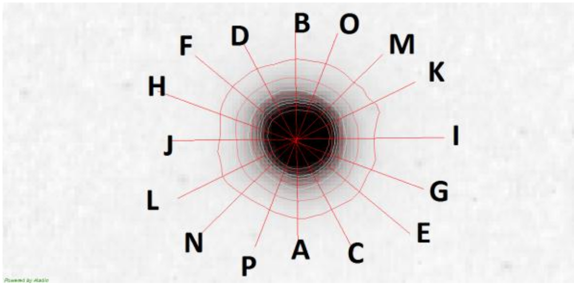

Fig 2: *isocontours and diameters of Aldebaran*

The same procedure was applied for Fomalhaut as well as Rigel. The average background flux for Aldebaran was found to be 53.15

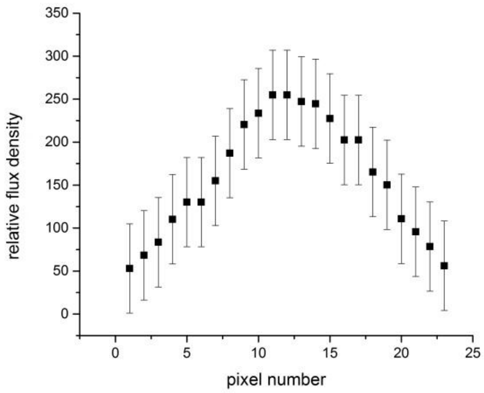

Fig 3: *flux density variation in Aldebaran along the diameter AB*

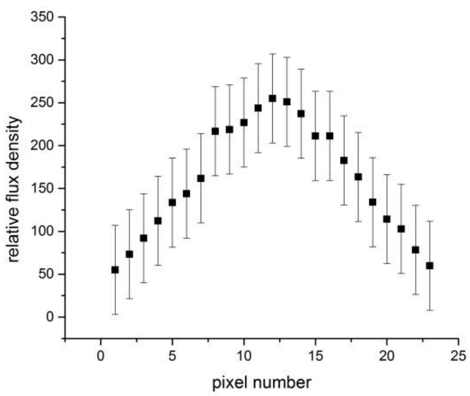

Fig 4: *flux density variation in Aldebaran along the diameter CD*

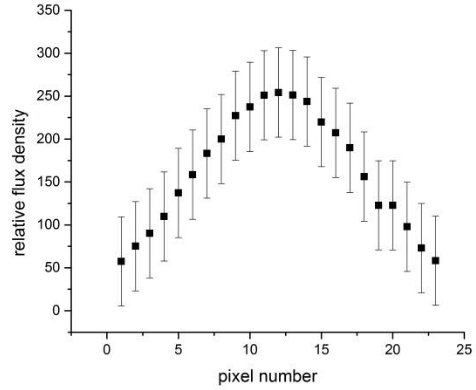

Fig 5: *flux density variation in Aldebaran along the diameter EF*

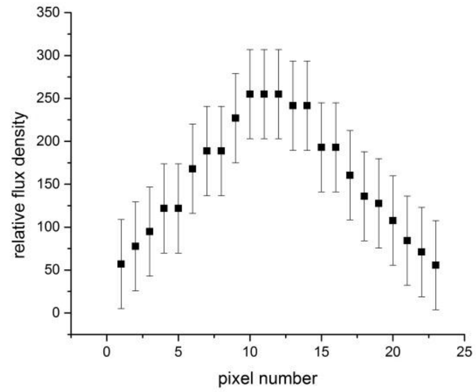

Fig 5: *flux density variation in Aldebaran along the diameter GH*

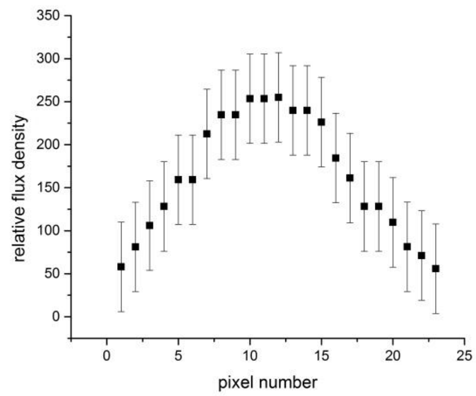

Fig 6: *flux density variation in Aldebaran along the diameter IJ*

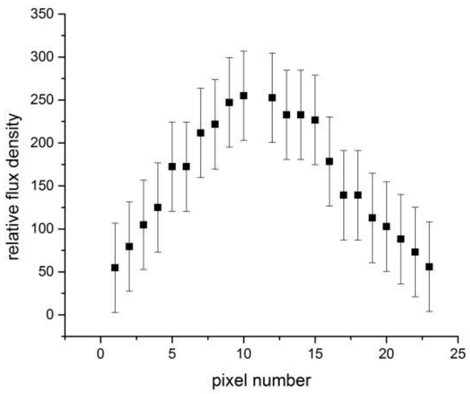

Fig 7: *flux density variation in Aldebaran along the diameter KL*

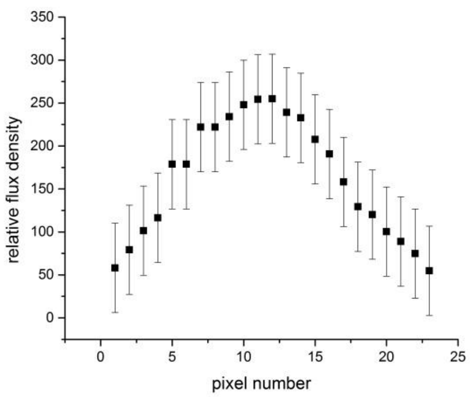

Fig 8: *flux density variation in Aldebaran along the diameter MN*

The flux densities along the various diameters were found to be Gaussian in nature. No anomalies were observed in the flux density variation along any of the diameters of Aldebaran.

Flux Density Variation in Fomalhaut

The measure of the background flux was found to be 41.13.

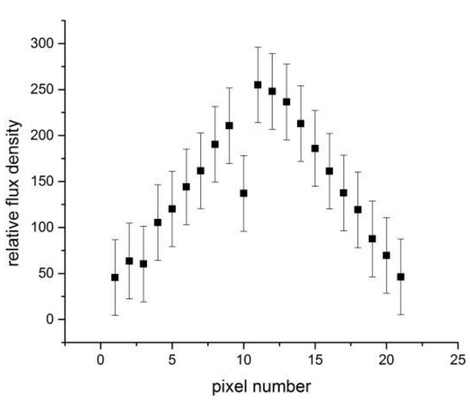

Fig 9: *flux density variation in Fomalhaut along the diameter AB*

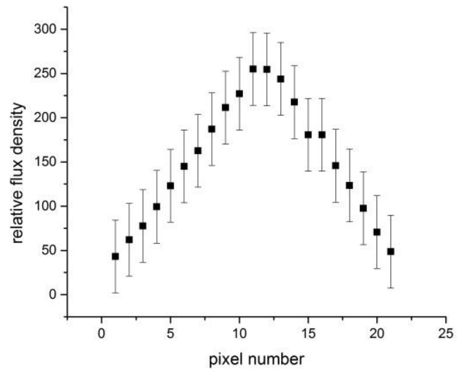

Fig 10: *flux density variation in Fomalhaut along the diameter CD*

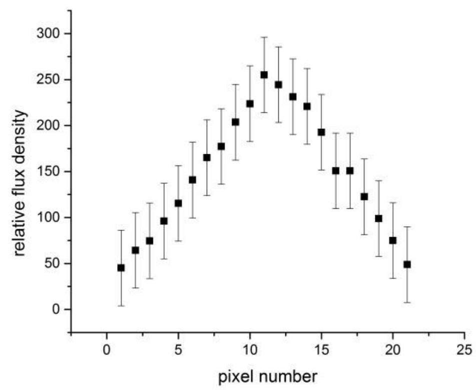

Fig 11: *flux density variation in Fomalhaut along the diameter EF*

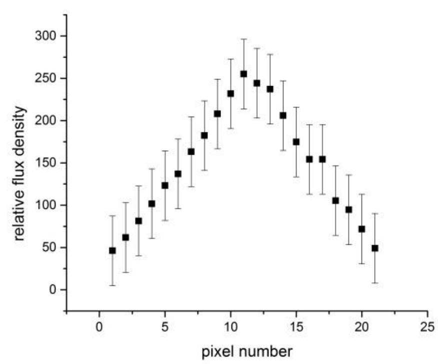

Fig 12: *flux density variation in Fomalhaut along the diameter GH*

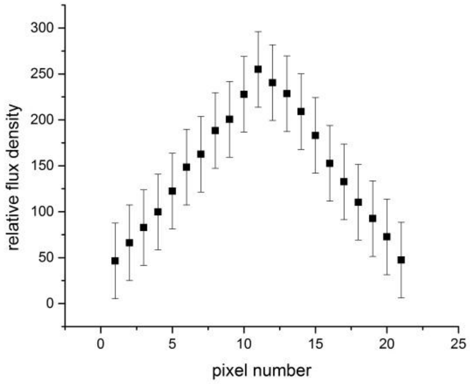

Fig 13: *flux density variation in Fomalhaut along the diameter IJ*

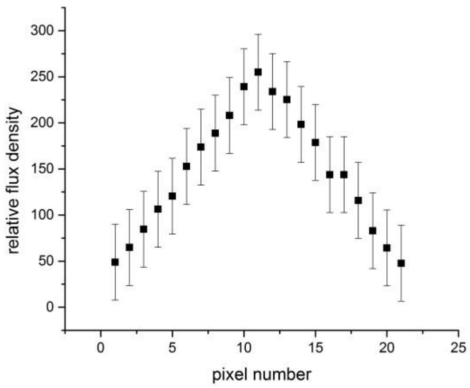

Fig 14: *flux density variation in Fomalhaut along the diameter KL*

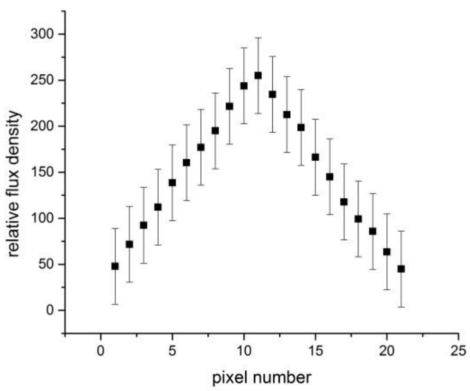

Fig 15: *flux density variation in Fomalhaut along the diameter MN*

The flux density variation along the various diameters of Fomalhaut was also found to be Gaussian in nature. No major anomalies were observed in the flux density variation of Fomalhaut except for along the diameter AB where along a particular pixel the value of the relative flux density dropped abruptly and rose to its normal value again in the next pixel

Flux Density Variation in Rigel

The relative flux density of Rigel along the various diameters is shown through figure 16 to figure 21.

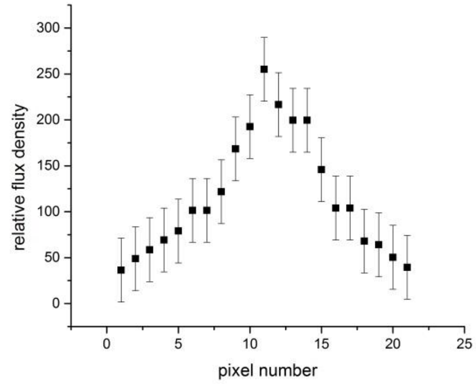

Fig 16: *flux density variation in Rigel along the diameter AB*

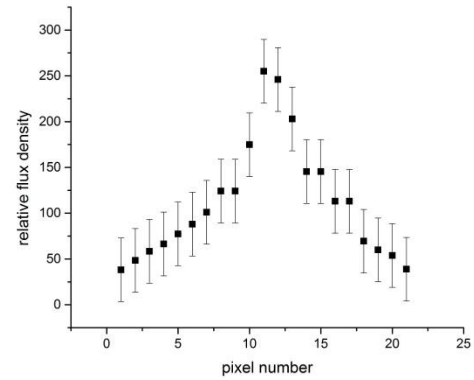

Fig 17: *flux density variation in Rigel along the diameter CD*

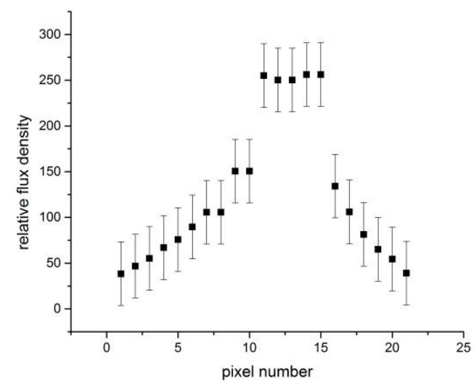

Fig 18: *flux density variation in Rigel along the diameter EF*

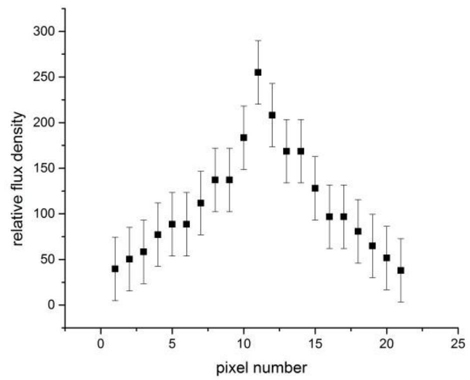

Fig 19: *flux density variation in Rigel along the diameter GH*

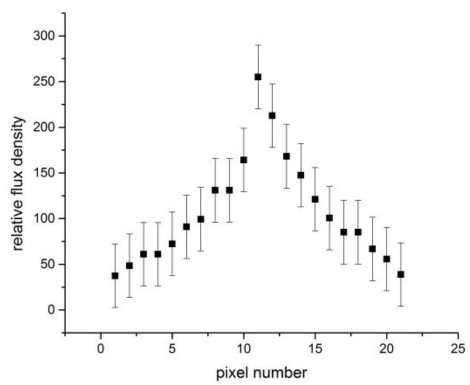

Fig 20: *flux density variation in Rigel along the diameter IJ*

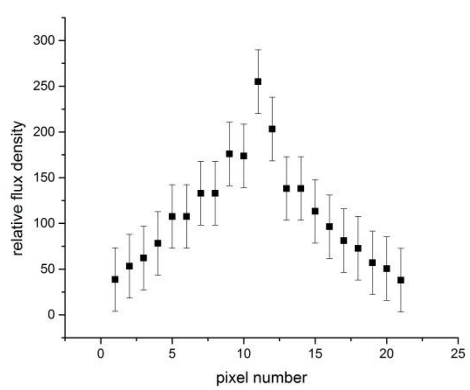

Fig 21: *flux density variation in Rigel along the diameter KL*

The flux density along the diameters of Rigel revealed that the pattern was normal in distribution. However, sharp peaks were observed in the innermost regions of Rigel which means that the most of the flux in Rigel is concentrated on the center of the region and tapers off sharply on either ends of the centers.

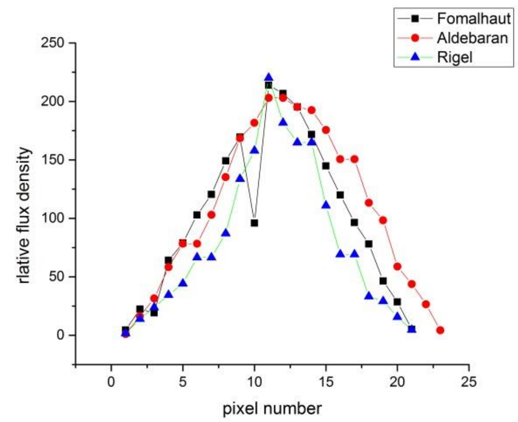

Fig 23: *comparison of the relative flux densities along the diameter AB*

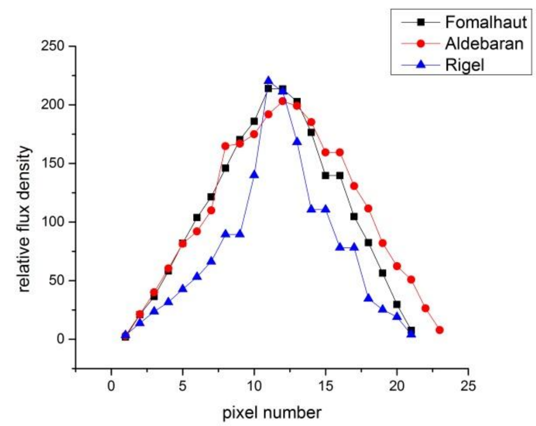

Fig 24: *comparison of the relative flux densities along the diameter CD*

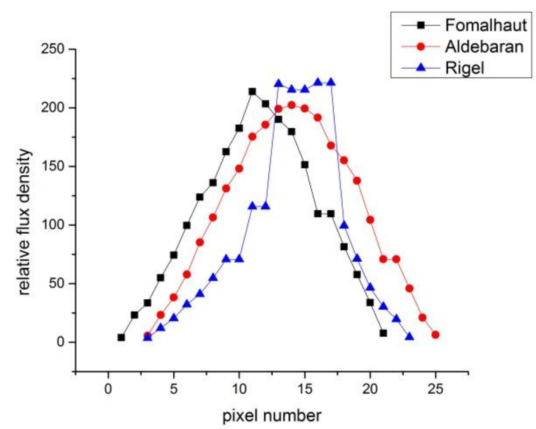

Fig 25: *comparison of the relative flux densities along the diameter EF*

Comparison of the Relative Flux density of the stars

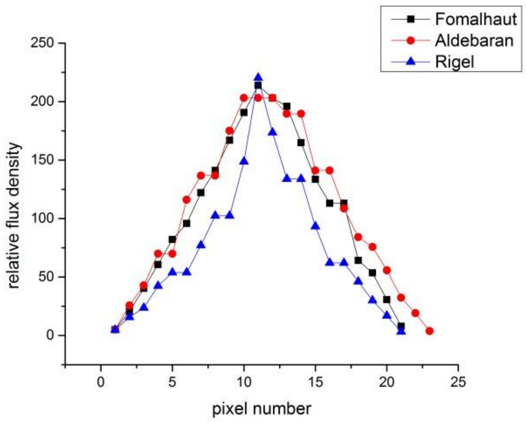

Fig 26: *comparison of the relative flux densities along the diameter GH*

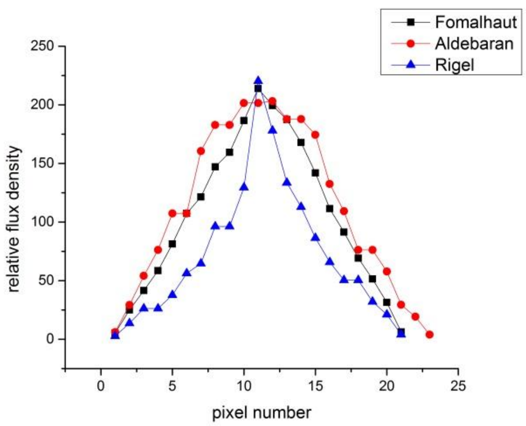

Fig 27: *comparison of the relative flux densities along the diameter IJ*

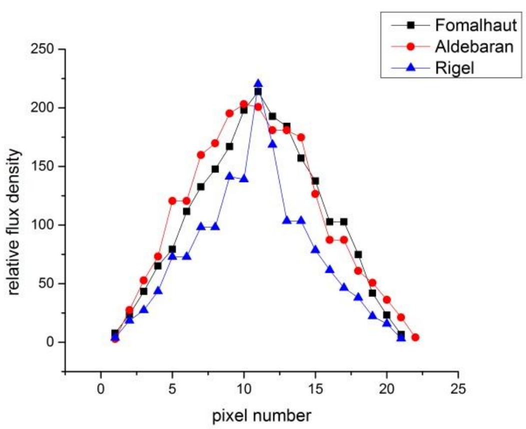

Fig 27: *comparison of the relative flux densities along the diameter KL*

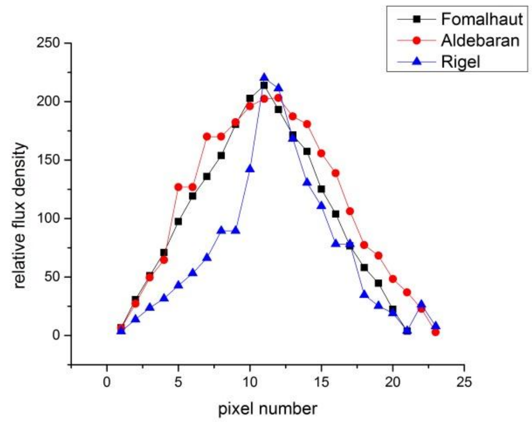

Fig 28: *comparison of the relative flux densities along the diameter MN*

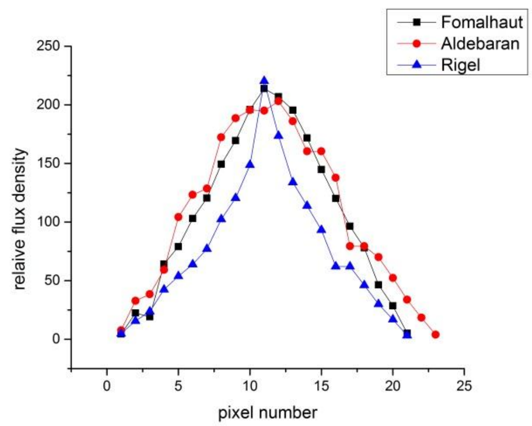

Fig 29: *comparison of the relative flux densities along the diameter OP*

We found that there was major inconsistency in the relative flux density of Fomalhaut along the diameter AB. We also found abnormal relative flux density along the diameter EF. This may have been due to the fact that several studies have suggested that there is a cloak of dust that surrounds Fomalhaut and the MEADE LX200GPS telescope at the Nagarkot Observatory might have detected the debris dust emission that have been reported in various astronomical observations[16], [17], [18], [19], [20], [21], [22], [23], [24], [25], [26], [27], [28].The sharp increase in the values of the relative flux densities might have been due to the fact that Rigel is one of the brightest objects and therefore tapered sharply.

CONCLUSION

Through the MEADE LX200GPS telescope at the Nagarkot Observatory, Nepal we have detected hint of the debris dust emission from the surface of Fomalhaut. Further we found that on average the relative flux densities along the pixels were found to be the lowest for Rigel and highest for Aldebaran.

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