Astronomy projects based on observations made with Faulkes Telescopes, handed out to the Board of Education - in Israel.

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Two month ago, in June 2009, each of three senior high school physics students, from West Galilee in Israel, handed out research project based on observations they made with the Faulkes Telescopes. The projects were handed to the Israeli board of education, 40% of the students final grade in physics was based on these projects. Their grades were excellent. The teacher that examined each of the students for more then an hour, said that if she could she would have gave much more then 100 to one of the students. Three more younger students, are still writing there projects, also based on observations they made with the Faulkes Telescopes and will hand out their projects this academic year. All the students learned astronomy and astrophysics for the whole year in a projects centre in the west Galilee, Israel. In this multicultural projects centre, Arab and Jewish school students from different schools in the area are learning and researching together different topics in physics and science.

It is the first time ever that students from Israel are using the Faulkes Telescopes and the first time they hand out astronomy projects that are based on observations they made all by their selves.

Their gaol in this research was to find the distribution of blue clusters in spiral galaxies, determent the types of the distribution and compare it to star formation area distribution types. This research confirmed the conclusions of a study by Brosch (1992), which is that it is possible to study the pattern of recent star formation in galaxies from colour images. Brosch's research was based on a Colour Atlas of Galaxies by Wray (1988), while this research was based on actual observations the students made with the Faulkes Telescopes. Each of the students, took and analysed images of one galaxy. The five different spiral galaxies were: NGC 5371, NGC 5921, NGC 3810, NGC 3596 and NGC 3631. These Galaxies were chosen since they are face on galaxies, has angular size smaller then 4.6 arcminutes so they can fit in one photograph made by the Faulkes Telescopes and had good visibility in the time of the research.

The pictures were made threw BVR filters for 120 seconds. Threw each filter the students took three pictures moving the telescope few arcseconds from one pictures to the other. After downloading the pipelined pictures they subtracted sky background using the software Aip4Win 2.0. Then they median combined the three pictures for each filter to get clean picture from cosmic rays and CCD local defects.

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[1] The writer is a physics teacher in high school in Israel for 15 years, and a student in Tel Aviv University.

In order to determent the colour index of each bright area in the galaxy that is suspected to be blue cluster, the students measured the flux from each area, in raw instrument units (ADU), then transformed it to magnitude. They made the transformation by getting the total magnitude of the galaxy in each filter, from the site NED, and getting the total flux from the whole galaxy from the fits file. Then after subtracting flux from stars in our galaxy they calculated the magnitude of each bright area using the formula:

$$m = M + 2.5 \bullet LOG\frac{S_1}{S_2}$$

whereas :
m - represent the magnitude of the bright area.

M - represent the magnitude of the whole galaxy from NED.

S_1 - represent the galaxy flux.

S_2 - represent the bright area flux.

After getting the magnitude of each bright area in blue and green they calculated the Colour Index: $m_B - m_V$ of each area. Blue clusters have typical Colour Index range, by comparing their results to this rang, the students were able to determined whether or not the area is a blue cluster. Then they built a table of number blue cluster against radial distance from the centre of the galaxy. They divided the galaxy to concentric rings, calculated the density of the blue clusters in each ring and finally plotted graph of density against radial distance. All three students graphs that are typical to the type of galaxy they took pictures of.

The density of HII reigns in galaxies has three typical types:

X - Where the density of HII reigns decreases steadily outward from the centre.

Y - Where the density oscillates while decreasing steadily outwards.

Z - Where the HII regions a ring-like (donut) distribution, with a deep minimum in the central region.

A similar classification is adopted for blue clusters here.

Yarden Turgeman, one of the students, wrote:
"According to the graph I discovered that the split category of the blue clusters in NGC 5371 is X type, in other words the blue clusters density descend from the centre outwardly."

Tal Kaiser conclusion was that the blue cluster's density type in NGC 3810 is X.

Zofia Weizmann conclusion was that the blue cluster's density type in NGC 5921 is Z but this conclusion wasn't conclusive, it might be Y.

Yarden concluded her work by saying:
"Although the hard work by doing the research days and nights, I really enjoy taking part in this project. As a result of this project I enrich my knowledge in astronomy, space and physics. I would like to thank the people who support and escort us by all of the process: Dr. Paul Roche and Mr. Fraser Lewis , who gave us unique opportunity to use the amazing telescope in Honolulu. It is a dream that came true! Thank you very much! ".

I would like to join to these words and thank Dr. Paul Roche and Mr. Fraser Lewis that made all this possible and supported us all along the way. I also would like to thank Dr. Noah Brosch and prof. Meir Meidav, my university academic guides in my thesis writing on the subject of high school students making astronomy research using robotic telescopes , in Tel Aviv university.

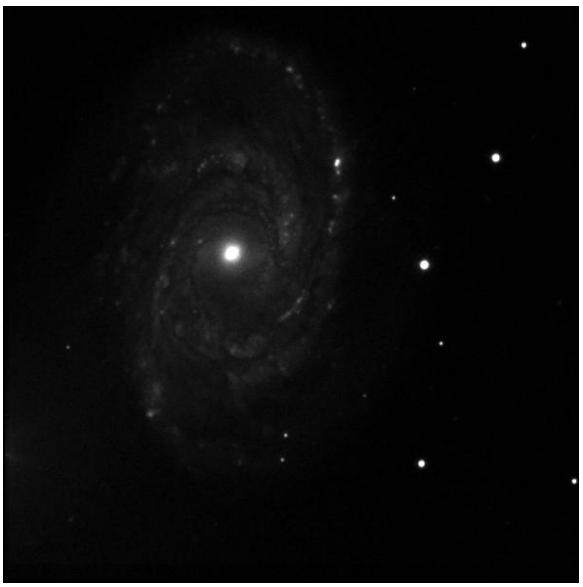
<u>Reference</u>:

Brosch, N. (1992).
Star formation systematics from colour images.
Astrophysics and space science 188, 289-298.

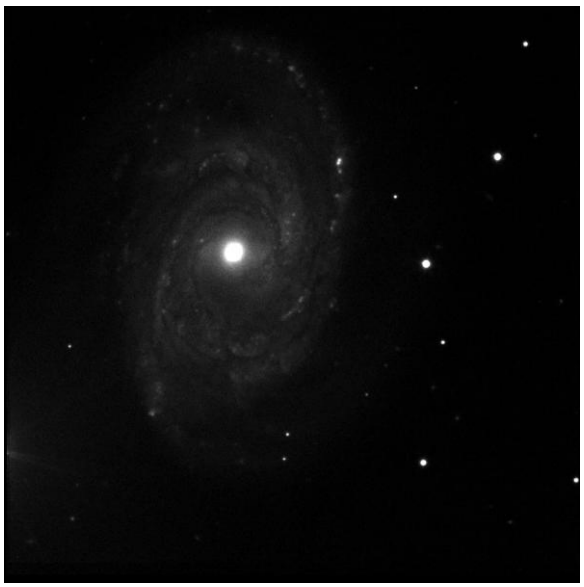
Wray, J. D. (1988).
The colour Atlas of Galaxies,
Cambridge University Press, Cambridge.

Pictures and graphs:

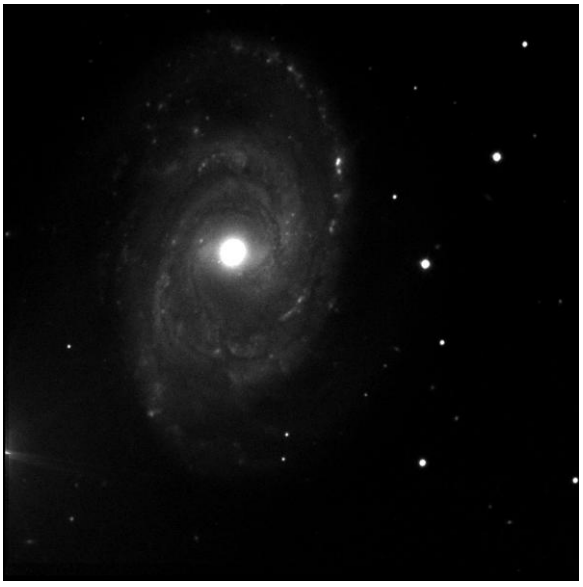
Picture 1 : NGC 5371 B filter.



Picture 2 : NGC 5371 V filter.

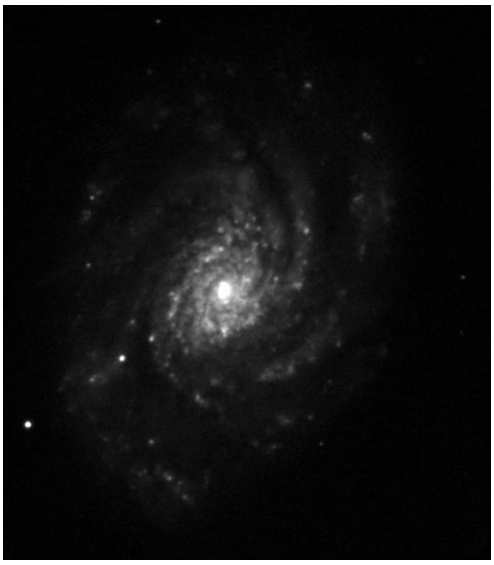


Picture 3 : NGC 5371 R filter.

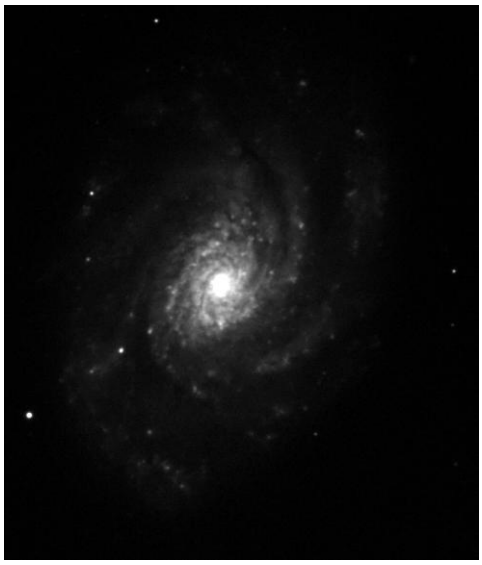


Picture 4: NGC 5371 B VR colore image.

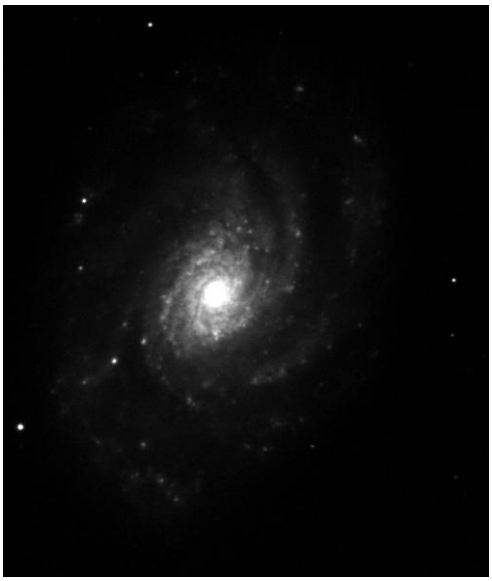
Picture 5: NGC 3810 B Filter.



Picture 6: NGC 3810 V Filter.

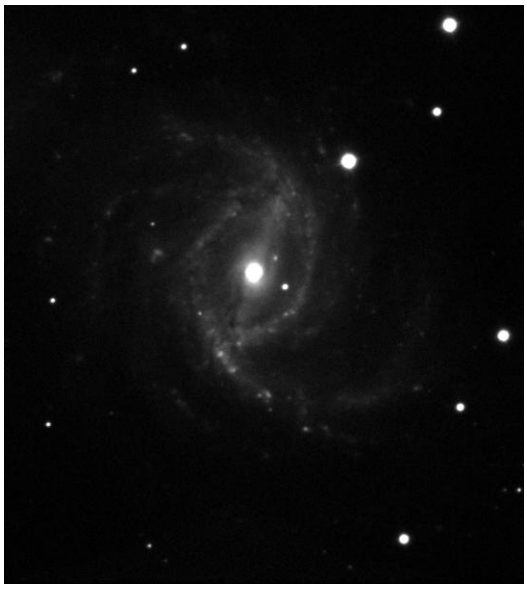


Picture 7: NGC 3810 R Filter.

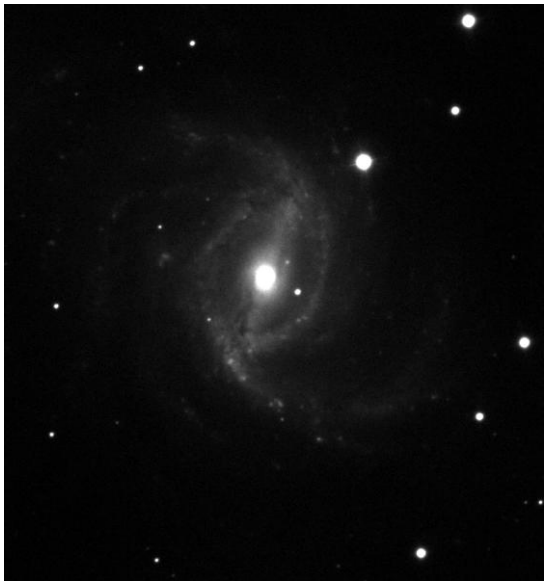


Picture 8: NGC 3810 BVR colore image

Picture 9: NGC 5921 B Filter.



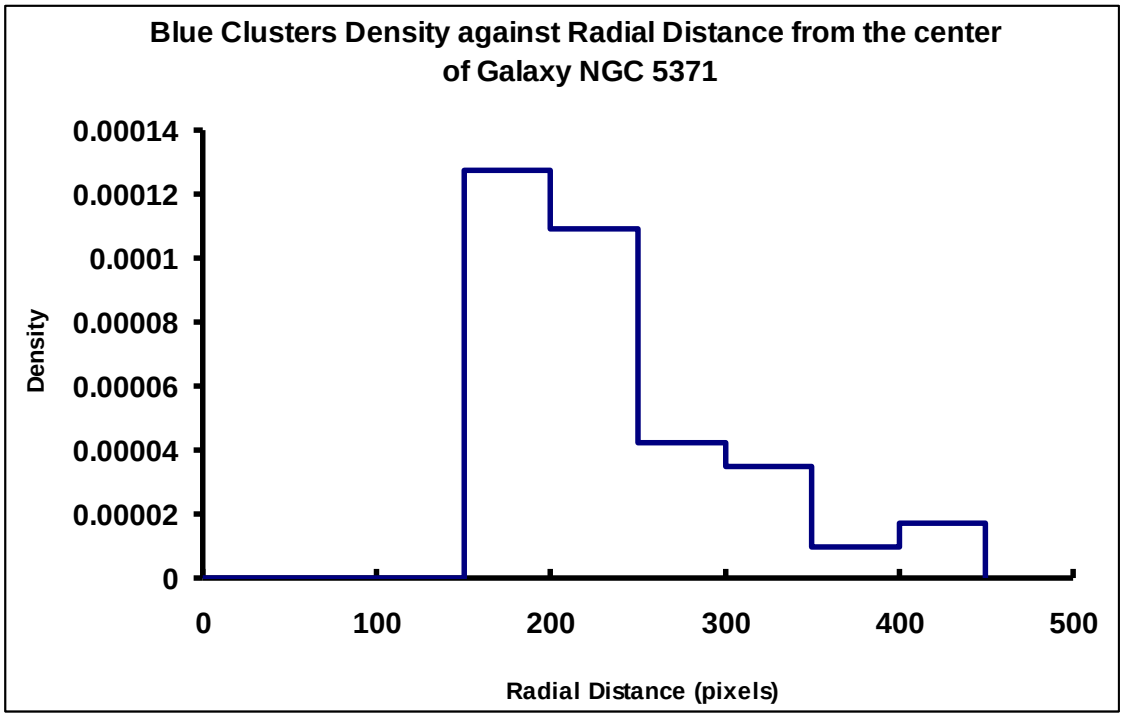
Picture 10: NGC 5921 V Filter.



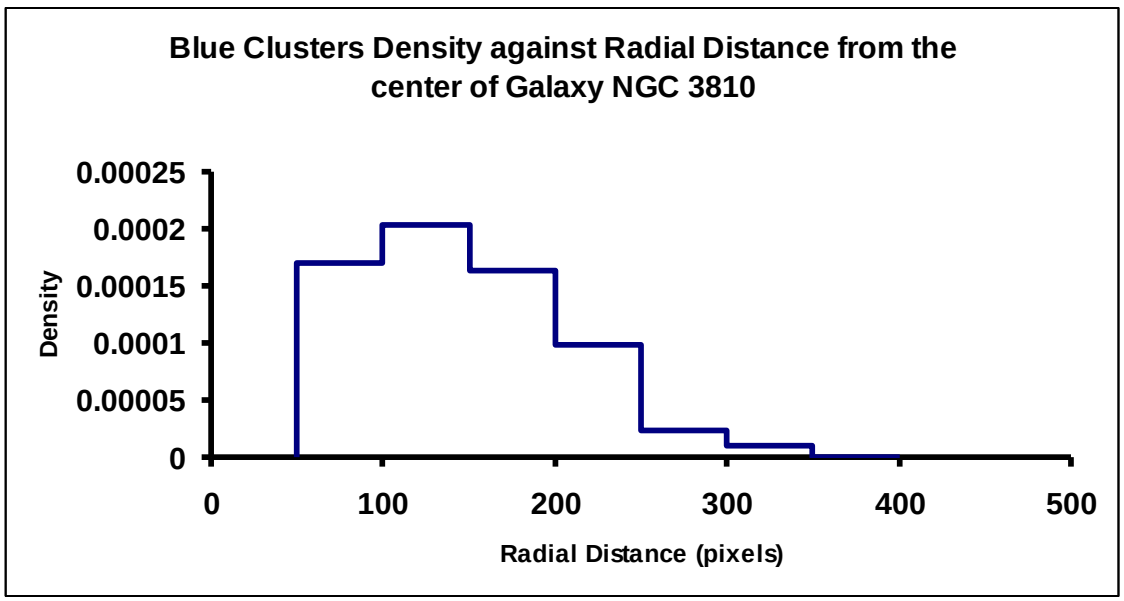
Picture 11: NGC 5921 R Filter.

Picture 12: NGC 5921 BVR colore image.

Graph 1 :
Blue Clusters Density against Radial Distance from the center of galaxy NGC 5371



Graph 2 :
Blue Clusters Density against Radial Distance from the center of galaxy NGC 3810



Graph 3 :
Blue Clusters Density against Radial Distance from the center of galaxy NGC 5921