

Name: _____ Form: _____

GCSE

Astronomy

Club



4.1 Galaxies and Cosmology

Our Galaxy The Milky Way

a) Describe the appearance of the Milky Way as seen with the naked eye and with binoculars or a small telescope

Draw a detailed image of how the Milky Way appears in the night sky with little or no magnification, with key features and nearby constellation clearly labelled.

apod.nasa.gov/apod/ap110405.html

b) Demonstrate an understanding that the observed Milky Way forms the plane of our own Galaxy

The Milky Way is the galaxy in which our solar system exists. We observe it from inside one of its spiral arms. It is only apparent in one part of the night sky, rather than being visible in all directions because:

the Solar System is inside the disk, and orbits in one of the spiral arms, about $\frac{2}{3}$

of the way out from the centre. We only see a band across the sky because we have no means of taking images from outside our galaxy, and we are looking at the combined glow

of all the stars in the disk.

c) Demonstrate an understanding of the size and shape of our Galaxy and the location of the Sun, dust, sites of star formation and globular clusters

Draw a view of the Milky Way as a distant observer would see it if they were perpendicular to the galactic plane. Include the location of the Sun, dust sites of star formation and globular clusters, and label the diameter of the galaxy, identifying the distance in light years.

Astronomy . nmsu.edu/cwc/CWC/LapTop/My Pictures/Astronomy/gal-schematic.jpg

(1 Kpc = 3.26 kly)

Draw a similarly labelled diagram as a distant observer would view our galaxy along the galactic plane.

images.slideplayer.com/1/221234/slides/slide_11.jpg

d) Demonstrate an understanding of how astronomers use 21 cm radio waves rather than visible light to determine the rotation of our Galaxy.

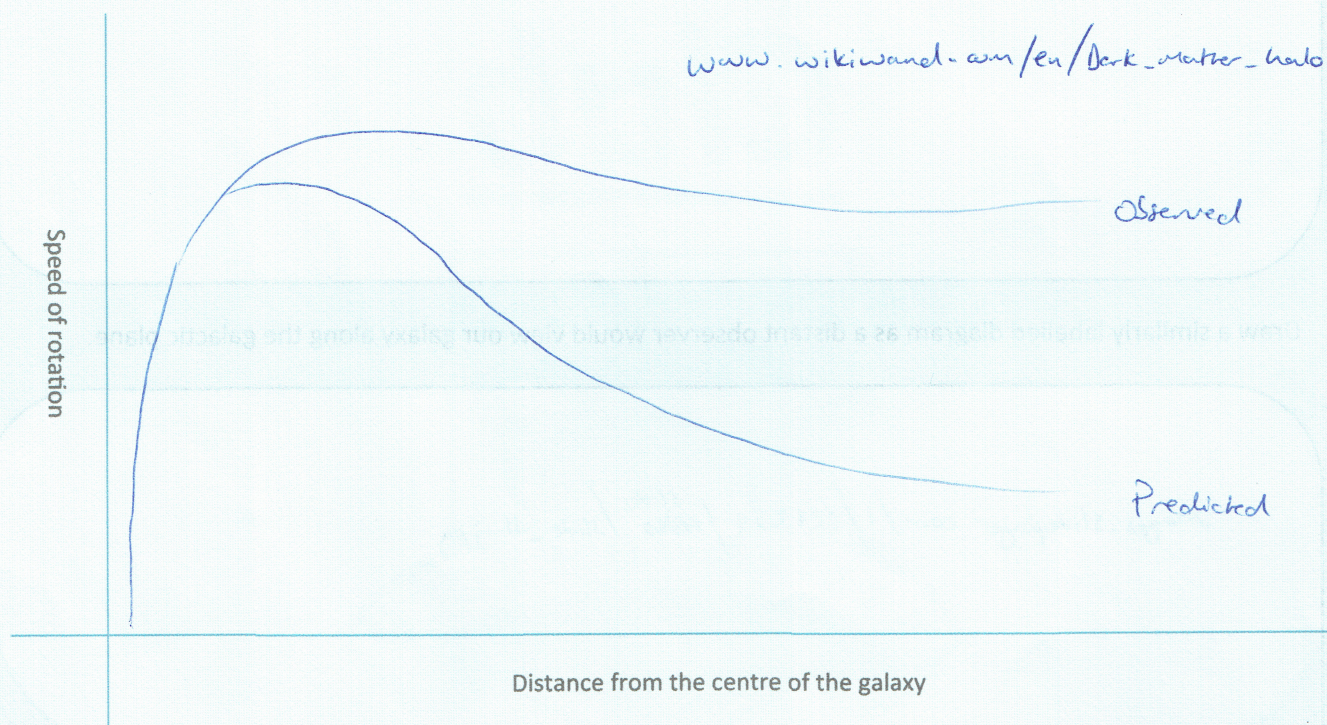
Astronomers are particularly interested in 21cm radio waves to observe the hydrogen in our Galaxy because:

this wavelength can penetrate the large clouds of interstellar cosmic dust that are opaque to visible light (can also pass through the Earth's atmosphere).

Assuming the hydrogen atoms are uniformly distributed, the doppler shifts in the hydrogen lines can reveal the relative speed of different parts of the Milky Way (rotation curve).

Astronomers use blue shift and red shift to determine: the orbital speeds at various radial distances from the galaxy's centre. Galaxies don't follow the usual orbital rules; rather stars revolve around their galaxy's centre at equal or increasing speed over a large range of distances. The mass observations for galaxies based on the light they emit are way too low to explain the velocity observations.

Plot the actual and predicted speeds of rotation for parts of our Galaxy as distance from the centre of the galaxy changes.



Explain how this relates to the prediction of the existence of dark matter: The discrepancy between these curves suggests an unusual mass distribution in galactic systems. (not a centrally dominated mass associated with observed luminous material). This has led to the hypothesis of dark matter and to assume its distribution from the galaxy's centre out to its halo. This matter would have a supposed gravitational effect on a galaxy's rotation curve, and make it more like that of a solar system. Either there is dark matter or the theory of motion under gravity (general relativity) is wrong!