

The presence of dark matter (DM) in the halo is inferred from its gravitational effect on a spiral galaxy's rotation curve. Without large amounts of mass throughout the (roughly spherical) halo, the rotational velocity of the galaxy would decrease at large distances from the galactic center, just as the orbital speeds of the outer planets decrease with distance from the Sun. However, observations of spiral galaxies, particularly radio observations of line emission from neutral atomic hydrogen (known, in astronomical parlance, as 21 cm Hydrogen line, H one, and H I line), show that the rotation curve of most spiral galaxies flattens out, meaning that rotational velocities do not decrease with distance from the galactic center.[11] The absence of any visible matter to account for these observations implies either that unobserved (dark) matter, first proposed by Ken Freeman in 1970, exist, or that the theory of motion under gravity (general relativity) is incomplete. Freeman noticed that the expected decline in velocity was not present in NGC 300 nor M33, and considered an undetected mass to explain it. The DM Hypothesis has been reinforced by several studies.