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# Observable Gamma-Ray Photon From Radiating Dark Hydrogen Atom

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***Abstract:** Dark hydrogen atom is a assumed stable state of selctron and sproton (super symmetric candidates of electron and proton). I calculated the allowed transitions in dark hydrogen atom, emitting dark photon in gamma region of electromagnetic spectrum. Observing gamma ray intensity from outer space by various detectors, could possibly detect the indirect presence of the existence of dark matter, since dark matter particle is not yet discovered.*



## I. INTRODUCTION

The large fraction of matter in the universe is dark (non-luminous) matter. The need to postulate dark matter was given by Fritz-Zwicky, who observed that galaxies in the coma cluster seemed to be moving to rapidly to be held together by the gravitational attraction of the visible matter.

The matter which we see or detect from instrument is just 4% of the total mass of the universe; 23% is the dark matter which is invisible, gravitationally attractive; and rest of 73% is the dark energy.

## DARK MATTER IN GALAXIES

The measurement of rotation curves of velocity versus radial distance for stars and gas in spiral galaxies , gives strong, if indirect indications for the existence of 'missing mass' in the form of non-luminous matter.

Consider the star of mass m at a distance r from the galactic center, moving with tangential velocity v.

If M be the mass of galaxy and G be the newton's gravitational constant.

Gravitational force between galaxy and star must be balanced by centripetal force on star.

$F_{gravitation} = F_{centripetal}$

$GMm/r^2 = mv^2/r$

$GM/r = v^2$

$v = \sqrt{(GM/r)}$

$v \; \alpha \; \sqrt{(1/r)}$

$v \; \alpha \; 1/r$ calculated behaviour

But experimentally we found

$v \; \alpha \; r$ observed behaviour

This makes a contradiction on large scale mass of the universe.

But Newton's law of gravitation must be hold on large scale mass

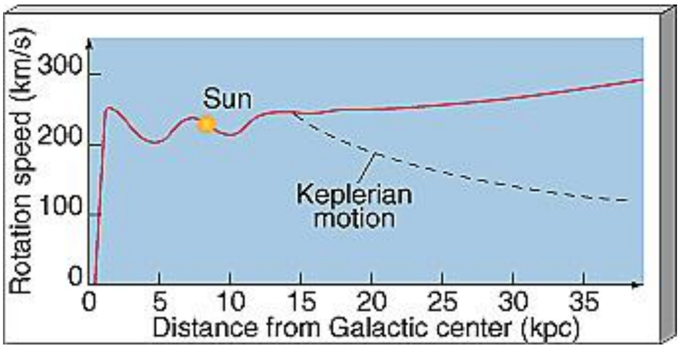


*Figure 1: rotation curve of our galaxy (milkyway) dotted curve represents. Calculated behaviour (v α 1/r) without dark matter, red curve shows the observed behaviour of our galaxy (v α r) when dark matter taken into account.*

One possible solution, in order to make theory and experiment

Consistent in the following way-

If we add sufficient mass (dark mass) in observed mass M then theory and observation satisfy each other.

$v^2 = G\,(M+M_{dark})/r$

Thus observed rotation can be explained.

This is how Physicists know dark matter exist.

## II. ENERGY LEVEL OF DARK HYDROGEN ATOM

Supersymmetry (SUSY) is a extension of standard modal(SM). Susy particles have a large mass as with corresponding standard modal particle mass.

According to SUSY, every SM particle have a heavy superpartner.

| Standard modal | supersymmetric partner |
|---|---|
| Electron | selectron |
| Proton | sproton |
| Neutron | sneutron |

Slectron, sprotron, sneutron are much heavier than standard model particle mass. There must be several constraints on mass there are

(~10 GeV, 100 GeV, 1000GeV).

Typical mass of proton in SM is ~ 1GeV

So in our modal we have taken mass constraint of 100 GeV.

Most of supersymmetric calculation showed that mass of SUSY particles must be 100 times of standard model mass.

Mass $_{SUSY}$ = 100 Mass $_{SM}$

Thus sproton is 100 times than proton.

Similarly selectron mass=100 x standard modal mass of electron.

Selectron mass = 100 x 0.511 MeV = 511 MeV

The simplest bound state model of dark hydrogen atom is, slectron orbiting around slectron just like Bohr's picture of Hydrogen in which electron orbiting around proton.

I have calculated various energy levels of dark hydrogen atom

Mass of proton $m_p$= 1836x mass of electron ($m_e$) ~ 1 GeV

Mass of sproton $m_{p'}$=100 $m_p$ = 100 GeV

Reduced mass of dark hydrogen atom

$m' = m_{e'} \times 100\, m_{p'} /(m_{e'}+100\, m_{p'})$

substituting values we have,

$m' = 99.9455\, m_e$

energy level of dark hydrogen atom

$E_n = -\, m_{e'}\, e4/(8\epsilon_0^2 h^2).(1/n^2)$

Where e is the electron's charge, and $\epsilon_0$ is the permittivity of free space and h is planck's constant, n is principal quantum number.

Substituting values we get

$E_{Gs} = -\,1360$ eV

Thus the ground state energy of dark hydrogen atom is 100 times than standard modal value.

The corrected energy levels of dark hydrogen atom

$E_{n\,Dark} = -\,136/n^2$ KeV

- ✓ Lyman transition occur in dark hydrogen atom when selectron transits to n=1 level from n=2,3,4......
- ✓ Balmar transition occur in dark hydrogen atom when selectron transits to n=2 level from n=3,4,5.....
- ✓ Paschen transition occur in dark hydrogen atom when selectron transits to n=3 level from n=4,5,6.....
- ✓ Bracket transition occur in dark hydrogen atom when selectron transits to n=4 level from n=5,6,7.....
- ✓ Pfund transition occur in dark hydrogen atom when selectron transits to n=5 level from n=6,7,8.....

The first transition from each series called H-alpha line of that transition. Hα line has larger wavelength of that transition.

- ✓ Selctron transition from n= 2 to n=1 gives Hα line of Lyman series.
- ✓ Selctron transition from n= 3 to n=2 gives Hα line of Balmer series.
- ✓ Selctron transition from n= 4 to n=3 gives Hα line of Paschen series.
- ✓ Selctron transition from n= 5 to n=4 gives Hα line of Brackett series.
- ✓ Selctron transition from n= 6 to n=5 gives Hα line of Pfund series.

I increased the mass of slectron by several times (100,200,300,400,500) ordianary mass of electron similary for sproton.

MASS 100 GeV means (mass of slectron and sproton increased by 100 times its standard model mass) and so on.

| | Mass 100GeV | Mass 200GeV | Mass 300GeV | Mass 400GeV | Mass 500GeV |
|---|---|---|---|---|---|
| Lyman Hα | 0.1200 nm | 0.0030 nm | 0.0013 nm | 0.0008 nm | 0.0005 nm |
| Balmar Hα | 0.0656 nm | 0.1642nm | 0.0073 nm | 0.0041 nm | 0.0027 nm |
| Paschen Hα | 0.1875 nm | 0.0469nm | 0.0209 nm | 0.0080 nm | 0.0075 nm |
| Brackett Hα | 0.4050 nm | 0.1013nm | 0.0452 nm | 0.0254 nm | 0.0162 nm |
| Pfund Hα | 0.7460 nm | 0.1865nm | 0.0832 nm | 0.0468 nm | 0.0298 nm |

*Table 1*



Typical gamma rays wavelength in electromagnetic spectrum - 0.001 nm to 0.1 nm.

- ✓ (Mass 100 GeV) Paschen, brackett, pfund H alpha can be experimentally observable.
- ✓ (Mass 200 GeV) Brackett, Pfund H alpha also experimentally observable.

## III. CONCLUSION

By measuring gamma ray energies from various part of the universe we could detect possible transitions of radiating dark hydrogen atom H-alpha of paschen, bracket, pfund can be detectable. There are various gamma ray detectors in space like Fermi gamma ray telescope and NASA-AMS-02 detector in international space station.

If our detectors found the gamma energy in that region we could indirectly verify the existence dark matter.

## REFERENCES

[1] Beiser.A. Modern Physics TMH
[2] Perkins.D.H. Particle Astrophysics ,Oxford University Press