© 2016 IJSRSET | Volume 2 | Issue 6 | Print ISSN: 2395-1990 | Online ISSN : 2394-4099
Themed Section: Engineering and Technology

Global Magnetic Field Strengths of Planets From A Formula

[1]G. UdhayaSankar, [2]C.GanesaMoorthy, [3]G.RajKumar

[1]Department of Physics, Alagappa University, Karaikudi, India
[2]Department of Mathematics, Alagappa University, Karaikudi, India
[3]Department of Electrical and Electronics Engineering, Nehru College of Engineering and Research Centre, Pampady, India

ABSTRACT

This article provides a derivation to evaluate proportionate values of magnetic field strengths of planets, assuming that planets are perfect in some aspects. The corresponding proportionate values are found for planets of our solar system.

Keywords: Magnetic Field of Planets.

I. INTRODUCTION

This is a continuation of the article [1] of the authors. It was observed in the article [1] that movements of materials lead to movements of electrons of the materials. So, rotations of planets lead to global magnetic fields of plants and internal movements of materials of planets lead to local magnetic fields of planets. It is assumed for derivation of a formula that planets have perfect spherical shape and they have uniform "electron velocity". In this article, "electron density" will mean the number of electrons in a unit volume.

II. METHODS AND MATERIAL

Derivation for the formula

Consider a rotating planet with radius R and with uniform electron density ρ. Let T be the fixed time required for one complete rotation about its axis of rotation. Suppose the axis of rotation lies in the z-axis and the equator-circle lies on xy-plane with centre at origin of the xyz-Cartesian coordinate space. Consider a circle C on the upper semi sphere which also lies on a plane that is perpendicular to the axis of rotation. Suppose the line joining any point on C with the origin makes an angle Θ with the xy-plane. Then the radius of the circle C is R Cos Θ. So, the magnetic field strength produced by the particles on the rotating disc containing C is directly proportional to

$$\int_{s=0}^{\mathrm{R\,Cos\,\theta}} \rho\left(\frac{S}{T}\right) ds,$$

when $2\pi/T$ is the angular velocity of any particle on the disc containing C. So, the magnetic field strength produced by the particles of the rotating planet is directly proportional to

$$\int_{\theta=-\pi/2}^{+\pi/2}\left(\int_{s=0}^{\mathrm{R\,Cos\,\theta}} \rho\left(\frac{s}{T}\right) ds\right)d\theta = \rho(R^2/2T)\left(\int_{\theta=-\pi/2}^{+\pi/2} \cos\Theta.\cos\Theta\, d\Theta\right).$$

This is directly proportional to $\rho(D^2/T)$, where D is the diameter of the planet. Thus the magnetic field strength of the rotating planet is $k\rho(D^2/T)$, where k is a constant which is universal for all planets, and which depends on the units for length, time, and energy for electrons.

III. RESULTS AND DISCUSSION

The two columns of the table presented here for diameter and rotating period are available in the website : nssdc.gsfc.nasa.gov/planetary/fact sheet/index.html. See [2] for additional information.

Planets	Diameter(D) (km)	Rotating Period(T) (hours)	Electron Density (ρ) (unknown)	D^2/T (km^2/hour)	Magnetic Field Strength $k\rho(D^2/T)$
Mercury	4879	1407.6	ρ_1	16911.5	$k\rho_1$ *(16911.5)
Venus	12104	5832.5	ρ_2	25119.0	$k\rho_2$ *(25119.0)
Earth	12756	23.9	ρ_3	6808181.4	$k\rho_3$ *(6808181.4)
Moon	3475	655.7	ρ_4	18416.4	$k\rho_4$ *(18416.4)
Mars	6792	24.6	ρ_5	1875254.6	$k\rho_5$ *(1875254.6)
Jupiter	142984	9.9	ρ_6	2065093359.0	$k\rho_6$ *(2065093359.0)
Saturn	120536	10.7	ρ_7	1357843673.0	$k\rho_7$ *(1357843673.0)
Uranus	51118	17.2	ρ_8	151921507.2	$k\rho_8$ *(151921507.2)
Neptune	45428	16.1	ρ_9	152361663.6	$k\rho_9$ *(152361663.6)
Pluto	2370	153.3	ρ_{10}	36639.9	$k\rho_{10}$ *(36639.9)

Variations in observations may happen due to the following assumptions in derivation of the formula: (i) Planets have perfect spherical shape, and (ii) Electron density ρ is uniform at all points of a planet. Variations may happen in view of the following aspects: (i) Solar wind, (ii) Cosmic rays, (iii) Magnetic field of other planets, (iv) Atmosphere, (v) Fluid materials of planets, which include moving hot materials in core parts, (vi) Variations in unknown electron density of materials (including ionized materials, and radioactive materials), and (vii) Magnetic materials.

IV. CONCLUSION

The formula has been derived for rotating spherical objects with uniform electron density. It is applicable to obtain proportionate values for global magnetic field strength values of planets.

V. REFERENCES

[1] C. GanesaMoorthy, G. UdhayaSankar, and G. Rajkumar, Rotating bodies do have magnetic field, International Journal of Scientific Research in Science, Engineering, and Technology, Vol.2 (6)(2016),155-156.

[2] D.R. Humphreys, The creation of planetary magnetic fields, Creation Research society Quarterly, vol.21, No.3, 1984, available in: http://www.creationresearch.org/crsq/articles/21/21_3/21_3.html.