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A Case In Favour of the Ejection Hypothesis for Planetary Formation

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Abstract

One of the great enigmas in Physics today is the fact that in spite of man's scientific and technological discoveries he is yet to understand how the planets in the Solar system were formed. Therefore several theories of planetary formation have been advanced and studied over the years. In this paper we make a case for the Ejection Hypothesis based upon the well established Principle of Conservation of Mechanical Energy.

1.0 Introduction

The Ejection Hypothesis is the assertion that the planets were formed by the ejection of matter from the sun which then came together under their internal gravitational attraction and then settled into orbits as we know them today [1 - 2]. One evidence in support of this hypothesis is the fact that all the planets possess extremely hot cores as the sun. Some of the planets are still completely gaseous as the sun itself. And even concerning the mechanism of the ejection its adherent point to the fact that the sun as well as other stars have been undergoing violent thermal activities [3]. Such activities range from solar flares [4] which spew a few tons of matter out of the sun of gigantic explosions shattering and scatterings stars completely as in supernova event [5]. In this paper we prove that the Ejection Hypothesis is perfectly consistent and compatible with the well established Principle of Conservation of Mechanical Energy in the solar system.

2.0 Theory

Consider the process in which matter of mass m is ejected from the sun and projection into orbit as a planet. Let the Sun and projected into orbit as a planet. Let the sun be assumed to be a spherical body of radius R and mass M. Let the orbit of the planet be an ellipse of semi-major axes a. Let V_e be the speed with which the mass was ejected from the surface of the sun. Then at the instant of ejection its total mechanical energy E_s is given by definition as

$$E_s = \frac{1}{2}mv_e{}^2 - \frac{GMm}{R} \tag{1}$$

Where G is the universal gravitational constant.

In the second place let E_0 be the total mechanical energy of the planet in orbit. Then by definition

$$E_o = \frac{1}{2}mv^2 - \frac{GMm}{r} \tag{2}$$

Where r and v are the distance from the sun and the corresponding speed of the planet at any instant in the orbit. In terms of the spherical polar coordinates (r,ϕ) we have

$$E_o = \frac{1}{2}m(r^2 + r^2\phi^2) - \frac{GMm}{r} \tag{3}$$

But it is well known that

$$\phi = \frac{l}{mr^2} \tag{4}$$

Where l is the orbital angular momentum constant. Hence (3) becomes

$$E_o = \frac{1}{2}m\left(r^2 + \frac{l^2}{m^2r^2}\right) - \frac{GMm}{r} \tag{5}$$

For convenience sake let us evaluate this energy at the aphelion distance r_1 for which

$$r_1 = 0 \tag{6}$$

Then

$$E_o = \frac{1}{2mr1^2} - \frac{GMm}{r} \tag{7}$$

It therefore follows from the well known relations

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$$l^2 = m^2 a(1 - \varepsilon^2) \quad (8)$$

And

$$r_1 = a(1 + \varepsilon) \quad (9)$$

That

$$E_o = -\frac{GMm}{2a} \quad (10)$$

Now it follows from (1) and (10) and the Principle of conservation of Mechanical Energy that the speed of ejection of the planet from the surface of the sun, V_e, is given by

$$v_e = \left\{2GM\left(\frac{1}{R} - \frac{1}{2a}\right)\right\}^{1/2} \quad (11)$$

Thus the principle of conservation of mechanical energy predicts the speed of ejection of the planets which can be calculated from the astronomical data for the solar system [6 - 8] as in table 1.

Table 1: Predicted speeds of ejection for the planets in the Solar System

planet	**Semi-major Axis a(m)**	**Ejection Speed V_c (ms^{-1})**
Mecury	5.79×10^{10}	6.168×10^5
Venus	1.082×10^{11}	6.167×10^5
Earth	1.496×10^{11}	6.170×10^5
Mars	2.279×10^{11}	6.170×10^5
Jupiter	7.783×10^{11}	6.176×10^5
Saturn	1.427×10^{12}	6.177×10^5
Uranus	2.869×10^{12}	6.177×10^5
Neptune	4.498×10^{12}	6.177×10^5
Pluto	5.900×10^{12}	6.177×10^5

3.0 Summary and Conclusion

In this paper we showed that id the planets in the solar System were formed by ejection of matter out of the sun then by the well established Principle of the conservation of mechanical Energy in gravitational fields the speed of ejection, V_e, is given by (11). Then we calculate these speeds for the planets from tables of astronomical data as shown in Table 1.

In the first place it is most interesting and remarkable that our analysis in this paper has led to a prediction of the speeds with which the planets were possibly ejected from the sun at formation about 4.6 billion years ago [7].

The second remarkable fact about the predicted speed of ejection of the planets is their closeness. This closeness may be evidence that all the planets were ejected by the same mechanism from the sun. Now since the predicted speeds of ejection of the planets are all real and of typical astronomical magnitudes it follows that the Ejection hypothesis is perfectly consistent with the hypothesis mechanism. Consequently the Ejection Hypothesis is plausible and physically tenable. In fact, based on physical grounds the Ejection Hypothesis may be the most favorable of all the available theories of the formation of the solar system.

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