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A VELOCITY INDEX FOR EXISTENCE OF ATMOSPHERE IN A PLANET

C. GANESA MOORTHY[a1], G. UDHAYA SANKAR[b] AND G. RAJ KUMAR[c]

[a]Department of Mathematics, Alagappa University, Karaikudi, India
[b]Department of Physics, Alagappa University, Karaikudi, India
[c]Department of EEE, Nehru College of Engineering and Research Centre, Pampady, India

ABSTRACT

An index is defined in this article by the expression: Sum of rotating velocity and orbital velocity divided by escape velocity. This index is used to discuss the nature of existence of atmosphere in planets.

KEYWORDS: Escape Velocity, Rotating Velocity, Orbital Velocity.

One has to simplify a complex model to understand its nature. A simplification is to be adopted in this article to understand the nature of existence of atmosphere. A particle in atmosphere of a planet can leave the planet, because of the following reasons: (i) Inertia of the particle or the orbital velocity of the planet; (ii) Self-rotating velocity of the planet, when the particle touches the planet; (iii) Heat distribution on the surface of the planet; (iv) Cosmic rays including sun rays; (v) Gravitational fields of the other planets; and (vi) Depletion in ionosphere containing ionized particles [See, for example, for reasons in (Prakash, S. and Pandey, R. ; 1984), (Singh, R.N. and Upadhyay, H.O. ;1991), (Vats, H.O. and Deshpande; 1980)]. This article is to consider for simplification the first two along with the escape velocity for the particle in the planet to define an index that determines retaining capacity of planets to retain atmospheres. Interpretation also considers strengths of ionospheres in planets, to derive final conclusions on existence of atmospheres in planets. The indices are computed for all classical planets of our solar system.

VELOCITY INDEX

If the velocity of a moving particle in the atmosphere of a planet exceeds escape velocity for objects of the planet, then the particle may escape unless other particles stop it. Two major reasons for particles to gain velocities to escape from planets are the self-rotating velocities and orbital velocities of the planets. Other factors are ignored, and a uniform 'velocity index' is introduced.

Velocity index = (Rotating velocity + Orbital velocity)/Escape velocity.

The earlier discussion implies the following conclusion. If the velocity index of a planet is less than or equal to 1, then atmosphere exists, that is, the atmosphere is retained; otherwise, it does not exist. However, non existence status of atmosphere may be converted into existence status of atmosphere, when there is a strong layer of ionosphere, which does not allow particles of lower layers to escape. In the table given in this article, some approximate data are provided for escape velocity, orbital velocity and rotating velocity, and these data are already available. See, for example, the website:nssdc.gsfc.nasa.gov/planetary/factsheet/index.html. Rotating speed at the equator can be calculated after conversion of units. (Table 1)

Table 1:

Planets	Escape velocity (km/s)	Orbital velocity (km/s)	Rotating speed at equator (km/h)	Velocity index
Mercury	4.3	47.4	10.8937	11.02
Venus	10.4	35.0	6.5226	3.37
Earth	11.2	29.8	1677.4140	2.70
Moon	2.4	1+29.8	16.6561	12.84
Mars	5.0	24.1	867.7317	4.87
Jupiter	59.5	13.1	45391.7170	0.43
Saturn	35.5	9.7	35404.3900	0.55
Uranus	21.3	6.8	9340.4651	0.44
Neptune	23.5	5.4	9668.2600	0.34
Pluto	1.3	4.7	48.5884	3.63

[1]Corresponding author

The orbital velocity of the moon is taken approximately as 1+29.8. The number 1 is for the orbital velocity of the moon around the earth, and 29.8 is for the orbital velocity of the earth around the sun, which should also be taken in account in calculating 'orbital velocity' of the moon relative to the sun.

CONCLUSION

- The velocity indices of Jupiter, Saturn, Uranus, and Neptune are less than 1. So, their atmospheres should remain in their planets.
- Mercury and Moon have very high velocity indices and they are greater than 1. They almost lost their atmospheres.
- Venus, Earth, Mars, and Pluto have moderate velocity indices, and they are also greater than 1. So, there are chances to lose their atmospheres, unless upper ionosphere layers are protected.
- Since Venus is near to sun, there may be enough ionized particles in the atmosphere, and they may retain the atmosphere in Venus. A similar reasoning is applicable for earth, but the amount of ionized particles in our earth should be less than the amount of ionized particles in Venus.
- Since Mars and Pluto are away from sun, their atmosphere may contain very few ionized particles in the atmosphere, and they may slowly lose their atmospheres.

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REFERENCES

Prakash S. and Pandey R., 1984. Rocket borne studies of electron density irregularities in equatorial D and E regions. Proceedings of the Indian Academy of Sciences-Earth and Planetary Sciences, **93**:283-308.

Singh R.N. and Upadhyay H.O., 1991. Lightning-generated waves escaping out through plasma holes in the nightside Venus ionosphere. Proceedings of the Indian Academy of Sciences-Earth and Planetary Sciences, **100**: 321-330.

Vats H.O. and Deshpande M.R., 1980. On the growth and decay of irregularities in the ionosphere. Journal of Earth System Science, **89**:137-143.