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Shukla Sun-Disk Evolution Theory (SSDE Theory) A Novel Mechanism of Solar System Disk Formation

Raghav Shukla,
Physics Lecturer
Mobile: +91 85328 97424
Email: sumitsharda11@gmail.com

Abstract:

According to the SSDE theory, particles (dust and gas particles) near the Sun get ionized by the Sun's heat and radiation. These ionized particles move in a counterclockwise spiral motion according to the Sun's rotating magnetic field. Neutral particles move in the same direction due to collision with ionized particles and angular momentum transfer. This process results in the establishment of an initial equatorial rotation and angular momentum.

The Sun's rotating magnetic field imparts an initial torque to the ionized particles, which becomes the source of "angular momentum" and is conserved throughout the proto-planetary disk.

Physical basis:
*Lorentz force: [f = q(v×B)]
*Thermal/photoionization theory
*Angular momentum: L = I × ω

Observations/peer-reviewed support:
*NASA observation (2015): [Counterclockwise planetary orbits]
*Hubbard (2016): [Magnetic field effect on ionized dust]
*McNally et al. (2020): [Ionized dust flows along magnetic field lines]

1.Introduction

The classical nebular hypothesis explains planet formation through gravitational collapse. However, it does not explain the source of the initial rotation impulse. The SSDE theory further suggests that the Sun's rotating magnetic field, electromagnetic forces, and the interaction of particles are the fundamental causes of planetary disk formation.

Physical basis: Lorentz force, angular momentum conservation
Peer-reviewed support: "Blum and Wurm" (2008),
NASA observations (2015)

2.Ionization mechanism – original contribution

Small particles of dust and gas near the Sun are ionized by thermal and photoionization.

* *Physical basis: [Thermal/photoionization, plasma physics]*
* *Observational support: [Solar magnetic field studies (2015)]*

Sun's rotating magnetic field → counterclockwise spiral motion of charged particles → collision/flux of neutral particles by angular momentum transfer → initial torque and momentum is generated → planetary systems are still conserved in the same counterclockwise direction.

* Physical basis: [Lorentz force: f=q(v×B)]
* Observational support: [Hubbard (2016), McNally et al. (2020)]

* Physical basis: [Angular momentum conservation, Elastic collision theory]

3.Neutral particle motion – (secondary contribution)

Since they were neutral and not directly affected by the sun's magnetism . they could not gain more speed than the Sun's magnetism and according to the formula f = mv^2/r, the centripetal force was not high, so they remained outside, while others were able to attach themselves with the help of magnetism and could gain speed, the centripetal force invited them to come inside. This is the reason why the inner planets have metals and rocks, while the outer planets have gas.

The Sun's rotating magnetic field and flux change → induced electromagnetic field (EMF) → electrons of particles are released → ionization → charged particles flow in spiral motion → elements of the nebula are aligned according to the magnetic field → inner region: metals, middle: rocks, outer: gases, outer most : neutral

References -

:- Paleomagnetic data from chondrules in meteorites suggest that the magnetic field in the early nebula was about 5–54 μT (from the study of the Semarkona meteorite).

:- MHD theory and modern studies show that the magnetic field has a decisive influence on the structure and motion of the protoplanetary disk.

:- Hannes Alfvén's Plasma–Magnetic Field coupling theory suggests that the plasma and electromagnetic field in the early nebula were closely coupled.

:- Centripetal force f=mv^2/r

. faraday's law of electromagnetic induction

. lenz's law

4.Planetary Disk Formation

(Planetary Disk Formation – Traditional Support)

The combined motion of ionized and neutral particles leads to aggregation leading to the formation of planetary bodies, which further evolve into planets. Gravity pulls the particle, leading to more aggregation in the equatorial regions. As a result, an equatorial planetary disk rotating in a counterclockwise direction is formed.

Physical basis:

**Gravitational accretion: f=GM.m/r^2*
** Angular momentum conservation: L=I×w*
**Peer review support: ["Blum and Wurm (2008), McNally et al. (2020)"]*

5. Conclusion

* Ionized particles near the Sun form an equatorial disk in counterclockwise motion driven by the electromagnetic field.
* Neutral particles flow in the same direction due to collisions and angular momentum transfer.
* Planets and planetesimals are formed as a result of gravitational and aggregation process.
*"The SSDE theory is a proven extension of the classical nebular hypothesis, explaining the source of the initial torque and the beginning of the rotation of protoplanetary disks".

Physical Basis: [Lorentz force, thermal ionization, angular momentum conservation]
Observation/Support: [NASA Observations (2015), Hubbard (2016), McNeely et al. (2020), Blum and Worm (2008)]

Note:

The SSDE theory does not deny the role of gravitational force. It considers gravity to be a dominant factor at the macroscopic (large-scale) level in the nebula system. However, at the microscopic (particle-level) level, electromagnetic forces dominate, representing the primary state of the nebula. Thus, the theory emphasizes a dual framework: electromagnetic dominance in the initial microscopic interactions and gravitational dominance in the subsequent macroscopic evolution.

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