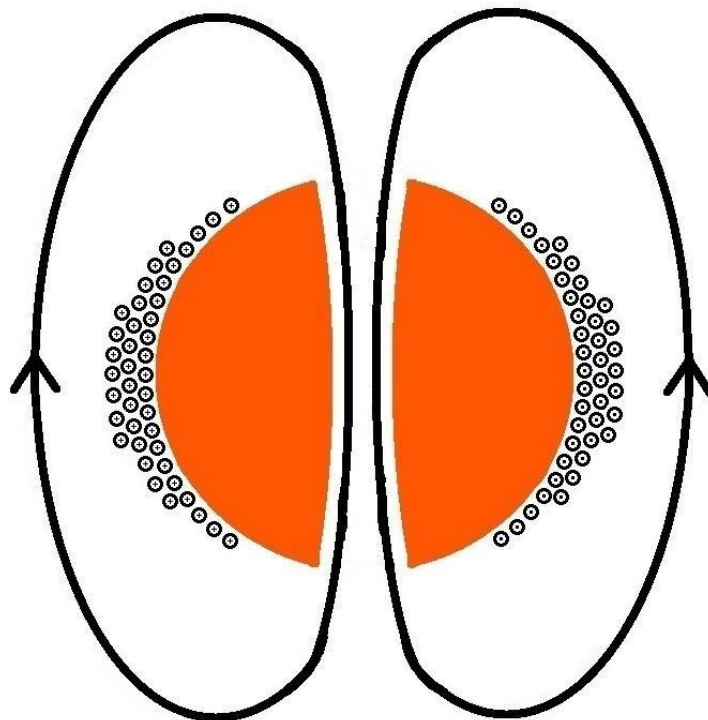




COMMENTS ON PLANETARY AND STELLAR MAGNETIC FIELDS





INTRODUCTION

In this study, I present observations on planetary and stellar magnetic fields.

Observation is the best source of knowledge.

I try to explain how planetary and stellar magnetic fields are formed, without, however, understanding what they are. There is a lot of things that we do not understand, but that we dare to explain. We do not know what life is, but it is always possible to theorize about what is a good life or what is a bad life. We do not know what gravitational attraction is, but we can explain that the masses form it by distorting space-time curvature.

I consider that science does not necessarily have to be complicated. It can be simple. History shows us that the observed phenomena that lead to scientific conclusions are quite simple, and that many of these phenomena happened by chance. Thus, I present this study in a very simple way, understandable to everyone.

These observations do not intended to exhaust the subject, nor to demonstrate that other observations may be correct or not. They are just another way of theorizing what planetary and stellar magnetic fields may be. I hope that it will serve as a stimulus for carrying out other studies, to develop new mathematical formulas, becoming another boost to scientific development.

Electromagnetism is easily observable and verifiable, but its study is quite intricate. The famous Maxwell equations (the most beautiful mathematical equations) describe the quantifications of electromagnetic phenomena, but they do not consider charge polarities.

PRELIMINARY COMMENTS ON TERRESTRIAL MAGNETISM

Albert Einstein described the origin of the Earth's magnetic field as one of the major unresolved problems that challenged modern physicists. Since then, there have been many studies on this topic.



I interpret that the basis of the currently explanation is still a matter of faith, because one believes in this or that. We must remember that theories are formulated based on the available information. Until today, no one knows for sure what the Earth's interior looks like, and we believe it may be responsible for the magnetic field. Nevertheless, much new information is already available.

Walter Maurice Elsasser (1904-1991), an American physicist born in Germany, is the "father" of the dynamo theory presently accepted as an explanation for

the Earth's magnetism. He proposed that this magnetic field results from electrical currents induced in the Earth's outer and fluid nucleus.

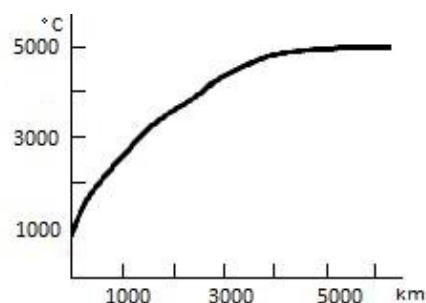
It is believed that the Earth's magnetic field is generated by electrical currents in the conductive iron alloys of its core, created by convection currents due to the heat that leaves the core, as well as that it originates from the intense electrical currents that circulate inside, and that it occurs as the nucleus moves, when the iron and nickel particles rub together energizing its ions, and also because the iron and the nickel in a state of fusion, at about 3 thousand km of depth, moves generating electric currents.

These movements are complex and are continuously studied using computational models.

On the other hand, we have to admit that the temperature of the terrestrial mantle is high enough for it to be somewhat pasty, so that there can be thermal convection of the mantle.

We know that the Earth's mantle consists of iron, nickel, cobalt and alloys formed by these elements (group of ferromagnetic materials).

Observing the graph below, we can infer that at 500m depth the temperature is approximately 1,500°C.





In addition, based on Marie Curie's studies, we only have to raise the temperature of a magnetized part to a certain level for the electron organization to become random (Brownian motion) and the magnetic alignment to be lost. This temperature is known as Curie Temperature.

material	Curie °C
Fe	770
Co	1,115
Ni	354

Therefore, we can conclude that the terrestrial mantle is not magnetic. By the same reasoning, the nucleus is still less magnetic. Nevertheless, the entire interior of the Earth is paramagnetic, which allows the magnetic field to pass through.

If that conclusion is true, we simply cannot believe that the Earth's magnetic field originated from something inside the planet.

If it does not come from within the planet, it can only come from something outside the planet.

MAGNETIC FIELDS OF OTHER PLANETS

We are not going to address exoplanets, but only those in our solar system.

MERCURY has no magnetic field. This is currently explained because its rotation is slow, equivalent to approximately 58 Earth hours, but it is also important to note that Mercury has practically no atmosphere.

VENUS has no magnetic field. This is currently explained because its rotation is very slow, approximately 116 Earth hours, although it has a very dense atmosphere.

MARS has no magnetic field. This is still not fully explained, as its interior is similar to that of the Earth, also with ferromagnetic materials, at a lower temperature - probably solidified. It is important to note that Mars has no significant atmosphere and that its day has approximately the same duration as the Earth day.



JUPITER has a very strong magnetic field. This is still not fully explained, as its non-gaseous interior is very small (compared to the outside diameter). It is important to note that Jupiter is practically just atmosphere, and that its day is shorter than the Earth Day, with only 10 hours.

SATURN has strong magnetic field. This is still not fully explained, because, although smaller than Jupiter, it has characteristics very similar to this one.

URANUS has a magnetic field. This is still not fully explained, as it is an essentially gaseous planet, without an interior with ferromagnetic materials. It is important to note that your day is similar to that of Earth, with approximately 17 hours.

NEPTUN has a magnetic field. This still cannot be explained, as it is an essentially gaseous planet, without an interior with ferromagnetic materials. It is important to note that your day is very short, with approximately 1 hour on Earth.

ATMOSPHERE AS A MAGNETIC FIELD SOURCE

From the hitherto exposed, only the atmosphere remains as the source of the planets' magnetic field.

Although the Earth various atmosphere layers move randomly, together, they follow the rotation of the terrestrial globe.

Observing the Earth thermosphere, or Ionosphere, we have that it consists of plasma, with electrons separated from the atoms, which become positive ions.

As the ionosphere turns around, the electrons movement generate the Earth magnetic field!

Observing the Earth troposphere, we see that the clouds are somehow electrified, but with low contribution to the earth magnetic field.

We must include the Van Allen belt as a magnetic field generator, as there are free electrons that also rotate with the rotation of the Earth.

Thus, Mercury and Mars do not have magnetic fields because they have no atmosphere, and the Earth, Jupiter, Saturn, Uranus and Neptune have magnetic fields because they have spinning atmospheres.



The explanation is because **only the movement of electrons forms magnetic fields!**

It is not possible to generate magnetic fields by moving cations (positive ions)!

In domestic experiments, I was unable to detect a magnetic field generated from the rotation of positive charges.

The conclusion I reached is that **only the movement of electrons forms magnetic fields!**

Experiments in well-equipped laboratories should prove or not this conclusion. There remains, then, the challenge for universities and electro technical or atmospheric institutes to prove or refute this conclusion.

We observe that everything that we know about electromagnetism always refers to the electron's behavior. Ferromagnetic materials become magnetized when their electron spins are aligned (there are no proton spins).

Furthermore, we observe that protons are neutrons without electrons! Experience shows that if you remove a neutron from an atom, in just ten minutes it will self-destroy, lose an electron and a neutrino, and become a proton.

A LITTLE BIT OF PHILOSOPHY

Although Goethe said that having certainty is a kind of attestation of ignorance, I, even if only alone, affirm that there is no positive charge.

There is only negative charge, that is, only electrons exist. Protons are what is left of a Neutron when an Electron is removed from it!

This is like saying that the darkness does not exist, but it is just the lack of light. Only light exists!

We can also say that evil does not exist, and that it is only the result of a lack of goodness. Humanity has always fought to obtain for itself what belonged to others.



Recent observations of monkeys that live on opposite sides of a river in Africa behave more gently or more aggressively depending on the side is richer or poorer in food, respectively.

We are the smartest monkeys.

STELLAR MAGNETIC FIELDS

In the galaxies study we can observe that the magnetic field lines orient themselves in the same direction as the spiral arms of the galaxy. This happens because the gravitational attraction between side-by-side stars (in the arms of the spirals) is greater than the gravitational attraction exerted by them in the arms direction. Thus, the lateral movement of the stars is greater than the radial movement of the stars. These lateral movements form the galaxy arms. Since stars consists of, among other things, plasma, and only the free electrons in the plasma are capable of generating magnetic field (cations, which move together with electrons are not capable of generating magnetic field), this lateral movement of the stars is what generates the magnetic field whose lines are detected.



Image of NASA SOFIA Telescope

Therefore, we are considering the stars as plasma balls, which they really are. The Sun is also a plasma ball, and, as it rotates, this rotating plasma generates a magnetic field beyond its photosphere. In addition, the Sun has many other movements within it, which generate numerous localized magnetic fields. The Sun is composed of 98% Hydrogen and Helium, which are not metallic, so the dynamo theory is impaired.

FINAL REMARKS

These observations are also not conclusive in relation to the inversions of the polarity of the terrestrial magnetic field throughout its existence. Currently, we believe that these inversions took place from the modification of internal movements on the planet. However, this may have occurred due to the change in the direction of rotation of the planet, which may have been caused by the incidence of large meteors, such as the one that generated the formation of the Moon and the one that extinguished the dinosaurs. On the other hand, it may be that these polarity inversions have not even occurred, and that tectonic movements, movement of volcanic lava and other movements have rotated the materials found in the earth's crust.



Furthermore, the present considerations do not explain how the South Atlantic Anomaly occurs. We observe that in this region the Van Allen ring is closer to the Earth's surface, so it may be that, therefore, the layer of the ionosphere is less thick in that same region, consequently with less influence on the intensity of the magnetic field.

A worrying aspect is that, as global warming increases the volume of the atmosphere, we may be losing more and more water to space. This lost water (approximately 9.5 m^3 per year) is in the ionosphere, which, consequently, is decreasing. If the ideas presented here are correct, the Earth's magnetic field is decreasing as an indirect consequence of the increase in the greenhouse effect. If the magnetic field becomes weak, the Earth will be bombarded, among other sources, by the harmful solar radiation, with unpredictable consequences.

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