RESEARCH ARTICLE

Similitude between the Earth's nucleus and the Earth–Moon barycenter

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Abstract: Being interested in problems which regard the Earth's rotation around its axis, we made some attempts to find the limits of the Earth–Moon barycenter inside the Earth. We found that the Earth–Moon barycenter surrounds the Earth nucleus. We also noticed that when the angle between the Earth equator and the Moon's orbit reaches its minimum value at 18.3°, the barycenter spiral with around 27 whirls surround only the inner core.

Keywords: Earth–Moon barycenter; Earth's nucleus; anisotropy of the inner core; nutation period

1. Introduction

We know that due to the Moon's orbital eccentricity, the distance between the Earth and the Moon varies continuously (between apogee and perigee) in each monthly orbital period of the Moon. Furthermore, due to its nutation period, the angle between the Moon's orbit and the Earth's equatorial plane changes for a period of 18.7 years. All of these have consequences on the Moon's position inside the celestial equatorial system and the Earth–Moon barycenter-related position inside the terrestrial coordinates.

As we are interested in the astronomical phenomenon of nutation[1], our aim was only to get an approximate image of the Earth-Moon barycenter trajectory; therefore, we considered in our calculus that the Earth and its geological composition have a homogeneous and spherical structure.

As the distance between the Earth and the Moon varies between 356,737 km and 406,649 km[2], it is obvious that the barycenter may be situated only inside two concentric spheres having their center in the same Earth center, with the radii of 4,335 km and 4,941 km, respectively. Due to the fact that the Moon declination can be situated only between 28.596° north of the celestial equatorial plan and 28.596° south of the celestial equatorial plan, the barycenter locus is putatively located between 20.55° south of the terrestrial equatorial plan and 20.55° north of the terrestrial equatorial plane (Figure 1).

After crossing the celestial equator, the Moon ascends to Taurus-Gemini border, where it has a turning point. During descension, the Moon will meet its southern turning point in Sagittarius.

During the nutation period, the position of the turning points depends on the mean ascending node of the lunar orbit in the ecliptic plane. When the longitude of the node line is zero, the turning point in the vicinity of the Taurus-Gemini border corresponds to the +28.596° declination, and the turning point in Sagittarius to the −28.596° declination. When the longitude of the node line is 180°, the declinations of the Moon's turning points vary only between −18.282° and +18.282°.

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doi: 10.18063/eoaa.v3i1.1209

2. The position of the Earth–Moon barycenter

Furthermore, we calculate the height of the barycenter position above and below the terrestrial equator, when the Moon is situated only in these extreme turning points positions.

We found that in the extreme case when the node line longitude is zero, the turning point of the barycenter is situated 2,365 km above or below the terrestrial equator when the Moon is in an apogee position, and 2,074 km above or below the terrestrial equator when the Moon is in a perigee position.

In the extreme case when the node line longitude is 180°, the turning point of the barycenter is situated 1,550 km above and below the terrestrial equator when the Moon is in an apogee position and 1,360 km above and below the terrestrial equator when the Moon is in a perigee position.

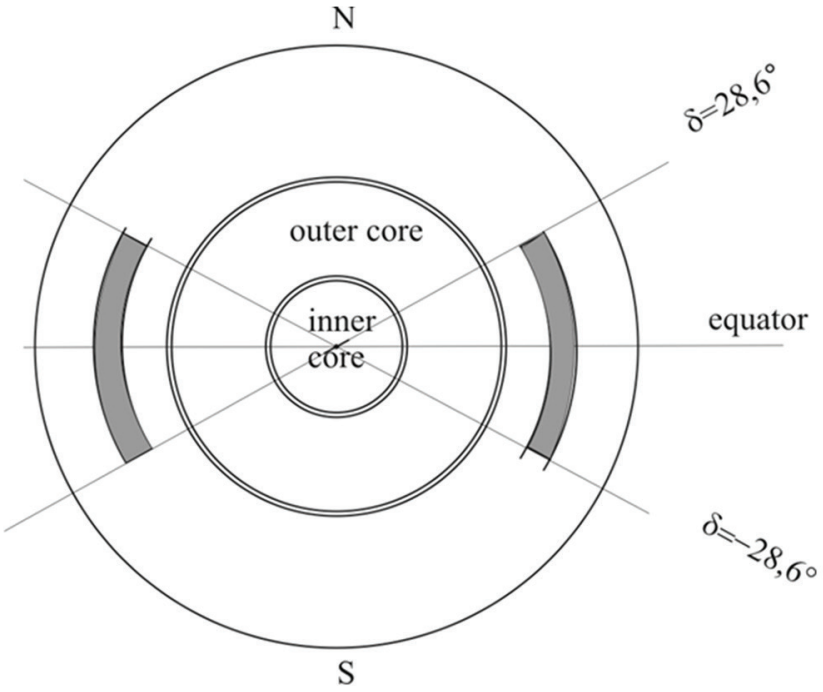

Figure 1. The Earth–Moon barycenter Belt (dark zone), a section inside the Earth.

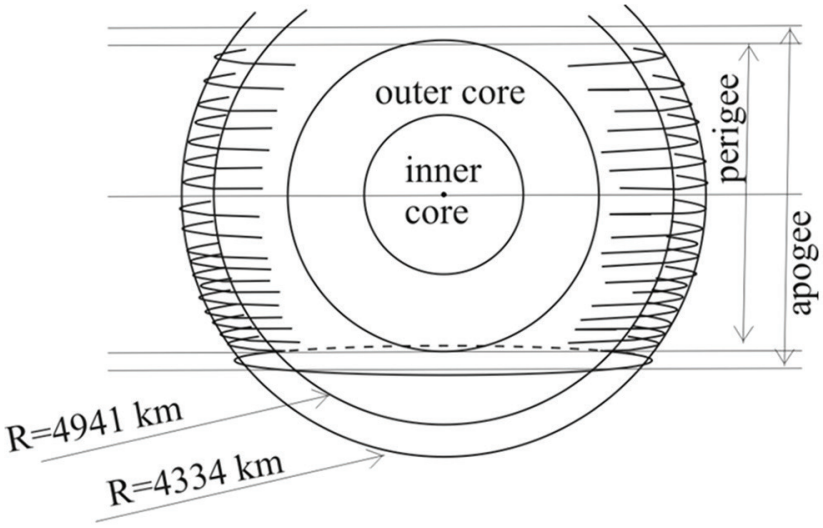

Figure 2. The barycenter spirals when the longitude of the mean ascending node is zero degree.

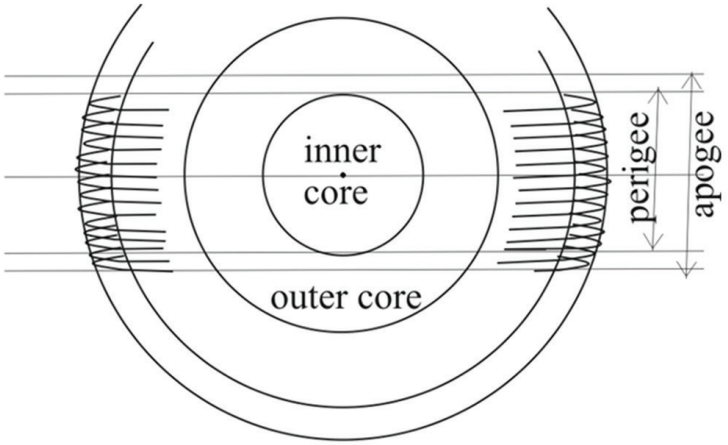

Figure 3. The barycenter spirals when the longitude of the mean ascending node is 180°.

3. The Earth's nucleus

In brief, it is admitted that the Earth's nucleus has two very important components: The outer core of about 2,400 km thickness, and the inner core, which looks like a solid ball with a radius of about 1,220 km. The Lehmann and Gutenberg discontinuities are around 200–300 km.

4. Possible correlation between the Earth's nucleus and the Earth–Moon barycenter?

Finally, we can say that the Earth–Moon barycenter surrounds the Earth's nucleus at a minimum distance of 800 km. Its trajectory has around 27 spirals in a draconic month, and the heights of the turning points depend on the longitude of the mean ascending node (Figures 2 and 3).

5. Conclusion

Our results were obtained assuming that the Earth has a spherical and homogeneous structure. However, even if we analyze just a simple latitude zone, there are differences regarding the Earth's crust composition. For instance, if we examine a 23° width belt (from equator, up to 23° north latitude), we remark that more than 60% of the crust are an oceanic one, which is distinct from the rest of the continental crust, including the heavy continental platforms of Africa, India, and Southeast Asia.

All these may indicate a possible discontinuity in the barycenter trajectory in the Malaysian region. Moreover, two great continental platforms, Australia and Southeast Asia, are approaching, as Wallace Line proves. An image from Apollo 11 shows that the appearance of the oceanic crust is very contorted. Thus, it is possible that the Earth–Moon barycenter trajectory is not a simple circular one in Malaysian region, during the daily, monthly, and nutation period[3].

We noticed that all the spirals of the Earth–Moon barycenter surround only the inner core when the angle between the terrestrial equator and the Moon's orbit is at its minimum value of 18.3 degree.

Could there be a correlation? We believe only a geophysicist that can answer this question.

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