GEOPHYSICS

Confirmation of Outer Atmospheric Asymmetry postulated to explain the False Zodiacal Light

In 1952 and afterwards[1-3], I suggested that the false zodiacal light—an early morning pyramid of light above the western horizon, resembling the zodiacal light which at that time would be on the opposite side of the sky—might be explained if Earth's gaseous tail were driven off mainly from the western twilight rim of the globe. I can now point to some recent findings that support this idea[4,5].

A terrestrial gaseous tail has been repeatedly postulated (by Lomonosov in 1753, Houzeau in 1888, Evershed in 1902, Astapovich[6], Fesenkov[6], Divari[6], and many others) to explain the counterglow or gegenschein, an antisolar luminosity with a variable brightness and a gaseous emission spectrum (Karimov[6], Tikhov), which Soviet parallax measurements place at an apparent distance of ~ 20 Earth radii. The gases forming such a tail could only be of atmospheric origin; presumably solar radiation pressure carries off atoms or molecules thermally expelled in high trajectories from the underlying denser atmosphere. I pictured "the solar heating steadily unwinding a ribbon of gas from the upper atmosphere into the ecliptic plane" (ref. 2, p. xviii).

The false zodiacal light, observed and named by Divari and Fesenkov in 1946 (ref. 6, p. 22) but previously described by Sykes[7] and by Schmid[7], is presumably a luminosity in the lower part of the tail, below the counterglow. The counterglow luminescence is thought to be excited by solar corpuscular emission in the region beyond the terrestrial magnetosphere (Astapovich[6]). To-day one may suspect that the nearer luminosity of the false zodiacal light is connected with the van Allen radiation, though other theories are possible[1,2,6].

Most remarkable is the asymmetry of the false zodiacal light: it is seen in the western sky as a post-midnight opening-out of the counterglow ellipse, but it is never seen in the eastern sky. If the gaseous tail itself is asymmetric, the reasons could be that (*a*) the rotation of Earth assists the solar radiation pressure at the evening twilight rim of Earth, but opposes it at the morning twilight rim; (*b*) at the evening twilight rim the atmosphere has been heated by the Sun, so that the supply of thermally accelerated exospheric particles, that is, the density of the exterior atmosphere, would here be significantly greater than on the morning rim (ref. 2, p. xvi).

Point (*b*) is now confirmed by the exospheric densities calculated from the orbital behaviour of artificial satellites. Beginning at ~ 200 km. height above the terrestrial ellipsoid, there is a minimum of density at 6 hr. true local time and a maximum at 14 hr. The difference between maximum and minimum steadily increases with altitude, and at 1,700 km., according to the model used by Römer[5], it exceeds two orders of magnitude. At 18 hr. the pressure remains high; at 700 km. height the supply of gas particles is ~ 7·5 times greater on the evening rim than on the morning rim of Earth (ref. 4, Fig. 4); at 1,700 km. it is ~ 12 times greater (ref. 5, Fig. 2).

The exterior atmosphere is chiefly maintained by solar energy absorbed and stored at lower (*F*-layer) levels. This explains the lag of the density maximum toward the afternoon and the continuing higher density in the evening.

The false zodiacal light, seen only in the west, must not be confused with the zodiacal twilight[8,9]—the atmospheric component of the ordinary zodiacal light—which according to Divari's specific finding appears with equal intensity on the western and eastern horizons. Moreover the zodiacal twilight is concentrated toward the horizon, while the false zodiacal light, opening out from the counterglow (Divari[6], Fig. 10), is strong at higher angles of elevation.

It is also obvious that the false zodiacal light, extending from the counterglow, is unrelated to the cosmic dust-cloud component of the ordinary zodiacal light. Aside from the nearness, the variability and the emission spectrum of the counterglow as demonstrated by the Soviet authors, there is Roach and Rees's demonstration[10] that the counterglow and the cosmic zodiacal light lie in slightly different planes. The former is, as expected, in the ecliptic, while the cosmic dust cloud is symmetrical with a plane through the Sun determined mainly by Jupiter's gravitation[11]. (Long-lasting confusion has been caused by the reports of those who profess themselves unable to find the slightest asymmetry or variability of the zodiacal light with respect to the ecliptic. These reports may be dismissed as pointless, because there is no imaginable reason why the zodiacal dust cloud around the Sun should lie precisely in the ecliptic, which is merely the orbital plane of the Earth.)

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BIOPHYSICS

Extendability of Tendons undergoing Contraction-Relaxation

Equilibrium melting of tendons[1] and collagenous tissues[2] follows the theoretical behaviour expected for a first-order phase transition. Thus, the ordered crystalline regions of polypeptide chains disintegrate into randomly oriented coils of the amorphous phase. Rat-tail tendons subjected to melting by lyotropic agents undergo rapid contraction followed by relaxation to rupture, and these physical events are easily measured characteristics of the melting process. Stress-strain curves of thermally shrunk tendons have been shown to obey equilibrium elastic theory for amorphous polymers[3]; for example, stress is proportional to $(a - a^{-2})$, where a is the strain. This communication deals, however, with a kinetic analysis of melting of rat-tail tendons in concentrated aqueous urea at *p*H 7·0 and 37° C.