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The permanence of cometary matter in interplanetary space

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Astrofisica. — *The permanence of cometary matter in interplanetary space.* Nota (*) di MASSIMO FRACASSINI e LAURA E. PASINETTI, presentata dal Socio F. ZAGAR.

RIASSUNTO. — Confrontando alcuni recenti risultati sperimentali e ricerche teoriche sulle variazioni della Luce Zodiacale (L.Z.) con il ciclo solare, e le precedenti ricerche degli AA. sull'attività cometaria e le variazioni della L.Z., sembra possibile dedurre che la permanenza della materia cometaria nello spazio interplanetario, è di circa 4–5 anni.

Viene suggerita qualche idea per la verifica sperimentale di questa ipotesi mediante sonde spaziali.

After about one year from the conclusion of a note [1] of the writers on the cometary contribution to the Z.L. and to the airglow, two interesting papers [2], [3] on the solar activity and the Z.L. are appeared.

In the note [2] the AA. perform an accurate analysis of the 8223 pairs of photometric measurements of the night sky (in the direction of the Pole and the Zenit) executed at the Haute-Provence Observatory from 1953 to 1966 by a photometer equipped with a Lallemand photomultiplier and a broad band-pass interference filter centered on 5260 Å.

By means of these measurements the AA. have made a statistical separation between the stellar component (stars of magnitude ≥ 6) and the zodiacal component of the extraterrestrial brightness of the night sky at the Zenith, and have deduced a curve of the eleven years variations of the Z.L., which is possible to compare to the curve of the solar cycle (relative numbers R of the sunspots) for the period 1953–1965.

By the consideration of these two curves the AA. conclude that the Z.L. reaches its greatest brightness during the two years preceding a solar minimum (for the examined period, in 1960–1961); moreover the minimum of the brightness occurs soon after the solar minimum (for the examined period, in 1956–1957) with an amplitude of the variation of about 25 %.

If we deduce an analogous mean curve from the graphs of the total annual absolute magnitudes, ΣH_{10} (1), reported in ([1] p. 273) and put it together the curves reported in ([2] p. 3), we obtain the following figure 1.

It shows that the curve of R and the mean curve of ΣH_{10} are perfectly in phase, and ΣH_{10} has a total amplitude of the variation of about 30 %. The mean curve of the ΣH_{10} is shifted of about four years, if compared to the curve of the Z.L. intensity; this fact could signify that the permanence of the

(*) Pervenuta all'Accademia il 1° luglio 1967.

(1) As described in [1], the ΣH_{10} are the absolute magnitudes H_{10} of the comets appeared each year, *integrated* by means of the corresponding intensities in the Pogson's formula over the whole year.

cometary matter in the interplanetary space is of the order of about four-five years.

This conclusion could be supported by: 1) the data, supplied by Asaad in a recent paper [3], regarding the time required for the alignment of the dielectric particles 0.1μ, with the magnetic interplanetary field (about three years, near the Earth); 2) the calculations made by Elsässer and Schmidt [4] relative to the interaction of the dielectric particles (H_2O, which should produce Rayleigh scattering in the Z.L.) with interplanetary magnetic fields; according to this analysis the dispersion of these particles, by means of the Lorentz force, in the direction perpendicular to the plane of the ecliptic, should occur in a time less than 10 years.

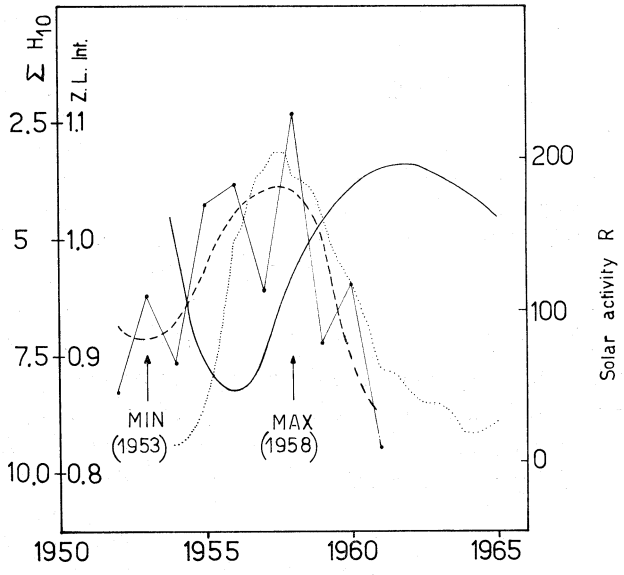

Fig. 1. – ··· relative number of the sunspots, ——— mean curve of the Z.L. intensity (by Weill-Dufay [2]); ●—●—●—● total annual absolute magnitudes (ΣH_{10}) of the comets (by Fracassini–Pasinetti [1]), ———— mean curve of the ΣH_{10}.

The results reported by the above mentioned AA. seem to be confirmed by the observations on the variations of the degree of the Z.L. polarization with the solar cycle [3] and by the degree of polarization of the Z.L. at greater ecliptical latitudes [4].

For completing the plot of the ΣH_{10}, the data concerning the comets which appeared in the year of the maximum (1958), are reported in Table I.

To evaluate the permanence of the cometary matter in the interplanetary space and eventually to confirm the hypothesis advanced by the writers in this paper, it would be very interesting to execute experiments like that proposed by Kresák [5] for determining shower-meteors impacts following the sun-grazing comets; or, one could simulate an expulsion of cometary matter

TABLE I.

NAME	T		q	H_{10}
1957 III	April	8.031	0.316	5.4
1957 IV	May	12.9	5.538	0.0–6.4 +
1957 V	August	1.438	0.355	4.5
1957 VI	September	2.338	4.446	0.6–5.9 +
1957 VII	September	8.29	1.385	12–14 +
1957 VIII	October	19.845	0.338	10.6
1957 IX	December	5.129	0.539	10.6
1958 I	January	20.077	1.517	13.8
1958 II	March	25.8	2.026	13.9

T = Time of the perihelion passage; q = Perihelion distance (A.U.); H_{10} = Absolute magnitude.
+ For these cases we have assumed the mean value.

at the distance of 1 A.U., putting in orbit a radioactivated ice-conglomerate nucleus (according to the comet model proposed by Whipple [6]), followed by a detecting device (a G.M. counter, a transmitting system) for the control of the radioactivity; the radioactive decrease will be proportional to the « evaporation » provoked by the solar radiation.

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