

SUMMARY REPORT ON ZODIACAL LIGHT, JULY 1964

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By
J. L. WEINBERG

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By

J. L. Weinberg

Astrogeophysics Division
Hawaii Institute of Geophysics
University of Hawaii

July 1964

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Introductory Remarks

A special session of Commission 21 (luminescence du ciel) of the International Astronomical Union will be convened at the XIIth General Assembly (August 1964; Hamburg) to consider the current status of research on the zodiacal light. This summary report was prepared to facilitate a critical review of the zodiacal light problem (with particular emphasis on results during the triennium 1961-1964) by participants in this special session.

Accurate measurement of the Stokes parameters of the night-sky radiation at high ecliptic latitudes is now possible, and careful calibration combined with new techniques for separating the zodiacal light from the airglow and starlight in these regions will contribute greatly to our understanding of the physics of the night-sky radiation in general and the zodiacal light in particular. In view of the considerable disagreement in observational results in the oft-observed bright portions of the zodiacal light and the ensuing difficulty in specifying the nature of the interplanetary matter, we have restricted ourselves to a detailed survey (numerical results, rather than a critique) of those results in the plane of the ecliptic that were available to the author.

This survey is presented in the form of tables and graphs of the surface brightness (radiance) and degree of polarization of the zodiacal light as a function of elongation, ϵ , in the plane of the ecliptic. No distinction is made between morning and evening observations, and, whenever possible, the spectral region or effective wavelength is specified.

Surface brightness of
plane of the ecliptic

Notes (see p. 5)

					i.	ii.	iii.
Color	UV	4060Å	4140	4355	4470	4500	4500
€	B 1955	D-K 1963	D-A 1960	P 1961a	BL-I 1961b	LVR 1937	REG 1955
5°							
10							
15							
20							
25				3150	3080		
30				1660	1641		2335
35			900	1230	1100	2295	1690
40	750*	1140	690	926	785	1691	1270
45	498	690	530		616	1323	
50	400*	535	410	697	491	1063	820
55					407	864	
60	295*	350	300	380	343	719	542
65						622	
70	255*	220	220	292		538	
75						468	
80		150	160	246		414	
85	287					371	
90			110	223		329	
95	186					297	
100			77	191		270	
105							
110	160						
115						255	
120							
125							
130	177						
135							
140							
145	169						
150							
155	127						
160							
165	144					255	
170						305	
175	93					335	
180							

* interpolated value

Table 1a.

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f the zodiacal light in the
in $S_{10}(\text{vis})$ units (see p. 5).

iv.				iv.	v.		
4630	blue	blue	5220	5280	5300	5300	5300
RO	B	E-S	D-A	RO	RPTD	R-RE	W
1962	1955	1957	1960	1962	1954	1956	1963b
1938	1817			2108	2331		2200
1176	1155*			1275	1594		1525
860	896	700		938	1184		1130
658	700*	500		759	945		900
553		390		637	755		730
488	425*	250		567	601		615
446				506	498		520
412	335*	170		455	426		445
					371		385
377		120		379	329		335
	203				297		300
		91			271		270
	177				247		250
		59			229		230
					211	250	215
	93	20					205
						215	195
							190
						195	185
							185
	110					180	190
							195
	127					175	200
							200
	118					170	205
182		95					215
	144	96				175	220
206		102					230
	118	110				185	240
265		117					245
						218	260

Surface brightness of the
of the ecliptic in $S_{10}(\text{vis})$

Notes (see p. 5)

Color	5410Å	5425	5430	5430	vi.	vii.	viii.	vi
€	D-A 1960	P 1961a	BE-S 1953	D-K 1963	F 1947	F 1947	D 1952	1930
5°								
10								
15								
20								
25		2570						
30		1820					690	3
35		1150	855			1.29	560	
40	740	875	725	880	480-550	1.00	430	2
45	570		615	680				
50	450	558	515	520	300-350	.55	220	7
55			450					
60	280	392	395	320		.33	140	
65			360					
70	180	320	325	200		.22	100	
75			290					
80	120	254	255	150		.15	70	
85			225					
90	74	232	200					
95								
100	65	211						
105								
110								
115								
120								
125								
130								
135								
140								
145								
150								
155								
160								
165								
170								
175								
180								

le lb.

page 3.

odiacal light in the plane
units, cont'd. (see p. 5).

			ix.			iv.		x.	
visual	visual	visual	visual	visual	yellow	6165	6200	6300	6380
H	E	KA	DUM	F	E-S	RO	BL-I	BL	P
,1932	1958	1961	1962,1963a	1964b	1957	1962	1961b	1956	1961a
							5170		
							3036		
22	1230			2700			1945	1206	2020
80	630	350-450		1330		1970	1340	856	1290
			($\epsilon=43^\circ$) 770			1320	972	638	1010
52	420	220		605		996	730	499	
						786	568	400	645
64	270		($\epsilon=57^\circ$) 462	355		650	449		
						545	365		432
44	180			226		476	301		
			($\epsilon=72^\circ$) 334			434	253		327
40	130			170					278
62	110					356			
									237
96									202
30									
88									
54									
76									
20			166						
64					170				
			166		175				
96					177				
					192				
218			200		207	273			

			Degree of polarization the plane			
Notes (see p.6) xii.			xiii.		xiv.	xv.
Color	?	blue	5220Å	5300	5410	5410
€	DU 1925	P 1961a	D-A 1960	W 1963b	D-A 1960	D-A 1960
5°						
10						
15						
20						
25						
30	.125			.148	.15	
35				.159	.16	
40	.125		.16	.171	.17	
45			.19	.183	.18	.17
50	.130		.21	.197	.19	.21
55			.21	.208	.20	.25
60	.150	.22	.22	.218	.19	.26
65			.22	.225	.18	.26
70	.130		.22	.229	.16	.26
75	.10	.17	.22	.226	.15	.25
80	.06			.217	.13	.23
85	.04			.204	.11	.22
90	.025	.15		.186		
95				.168		
100				.151		
105		.13		.135		
110				.120		
115				.107		
120		.12		.095		
125				.085		
130				.077		
135		.12		.069		
140				.058		
145				.042		
150				.027		
155				.016		
160				.006		
165						
170						
175						
180				.00		

tion of the zodiacal light in
e of the ecliptic.

xvi.			xvii.	xviii.			xix.
5430	visual	visual	visual		?	green	6200
D-A 1960	BE-S 1953	E 1958	RO 1962	HU 1951	T Y,1939	P 1961a	BL-I 1961b
							.100
							.152
.15		.20					.217
.16	.234		.10				.268
.17	.230	.29	.13	.15			.292
.18	.220		.14				.306
.20	.223	.31	.16	.20			.314
.22	.207						.320
.22	.190	.33	.19	.21	.15	.23	.32
.22	.172						.32
.21	.145	.36	.22	.19			
.20	.131					.21	
.18	.122	.35		.17			
.16	.116						
	.108	.36		.12		.20	
						.165	
						.16	
						.15	

Notes

Table 1a:

- i. These results were taken from a logarithmic plot and were converted from brightnesses in units of the integrated solar disk to $S_{10}(\text{vis})$ units using the solar spectral irradiance data of Johnson (1954).
- ii. The original paper does not include average results-only 4 sets of isophotes which differ with season. The results given here for $35^\circ \leq \epsilon \leq 100^\circ$ are an average of those isophotes as given by Roach, et al. (1954). The results for $\epsilon > 100^\circ$ were taken from Roach and Rees (1956).
- iii. As given by Peterson (1961). $4500\text{\AA}$ is the effective wavelength for this set of white-light observations.
- iv. To maintain internal consistency in Robley's work, we have used his conversion factors to express his results in $S_{10}(\text{vis})$ units.
- v. Roach, et al.'s (1954) Approximation III.

Table 1b:

- vi. As given by Karyagina (1961).
- vii. Distribution relative to the value at 40° elongation; as given by Divari (1952).
- viii. The spectral region was not given, nor was it stated whether the results are in photographic or visual units.
- ix. In the spectral region $4900\text{--}5500\text{\AA}$.
- x. "One morning observation only".

Notes (Continued)

Table 2:

- xii. This first quantitative determination of the polarization of zodiacal light was based on a photographic study of the night-sky radiation.
- xiii. One night's observation (26 October 1957).
- xiv. One night's observation (27 October 1957).
- xv. One night's observation (28 October 1957).
- xvi. Average of 3 nights and 2 colors.
- xvii. Average of results in blue and in green.
- xviii. Mean values from morning and evening results in 1945, 1948, and 1949. These results were obtained with 2 broad-band photoelectric units having maximum sensitivities in the visible (4500Å) and near infrared (7200Å).
- xix. Unsmoothed results of polarization measurements at 4470Å were also given (but are not shown here), and they appear to be slightly higher than the results at 6200Å.

Figure 1:

In Figure 1 we have plotted representative post-1950 results for the surface brightness of the zodiacal light as a function of elongation, ϵ , in the plane of the ecliptic. To more clearly indicate the disagreement in zodiacal light photometry, we have plotted results only in the visible spectral region ($\sim 5200\text{--}5600\text{\AA}$). The unit of brightness is 10th magnitude (visual) G0 stars per square degree ($S_{10}(\text{vis})$ units).

Figure 2:

In Figure 2 we have plotted the distributions of polarization which are listed in Table 2. Polarization measurements in the region $160^\circ < \epsilon < 180^\circ$ are still being analyzed, but the author was unable to detect any polarization at the anti-solar point (Weinberg, 1964a).

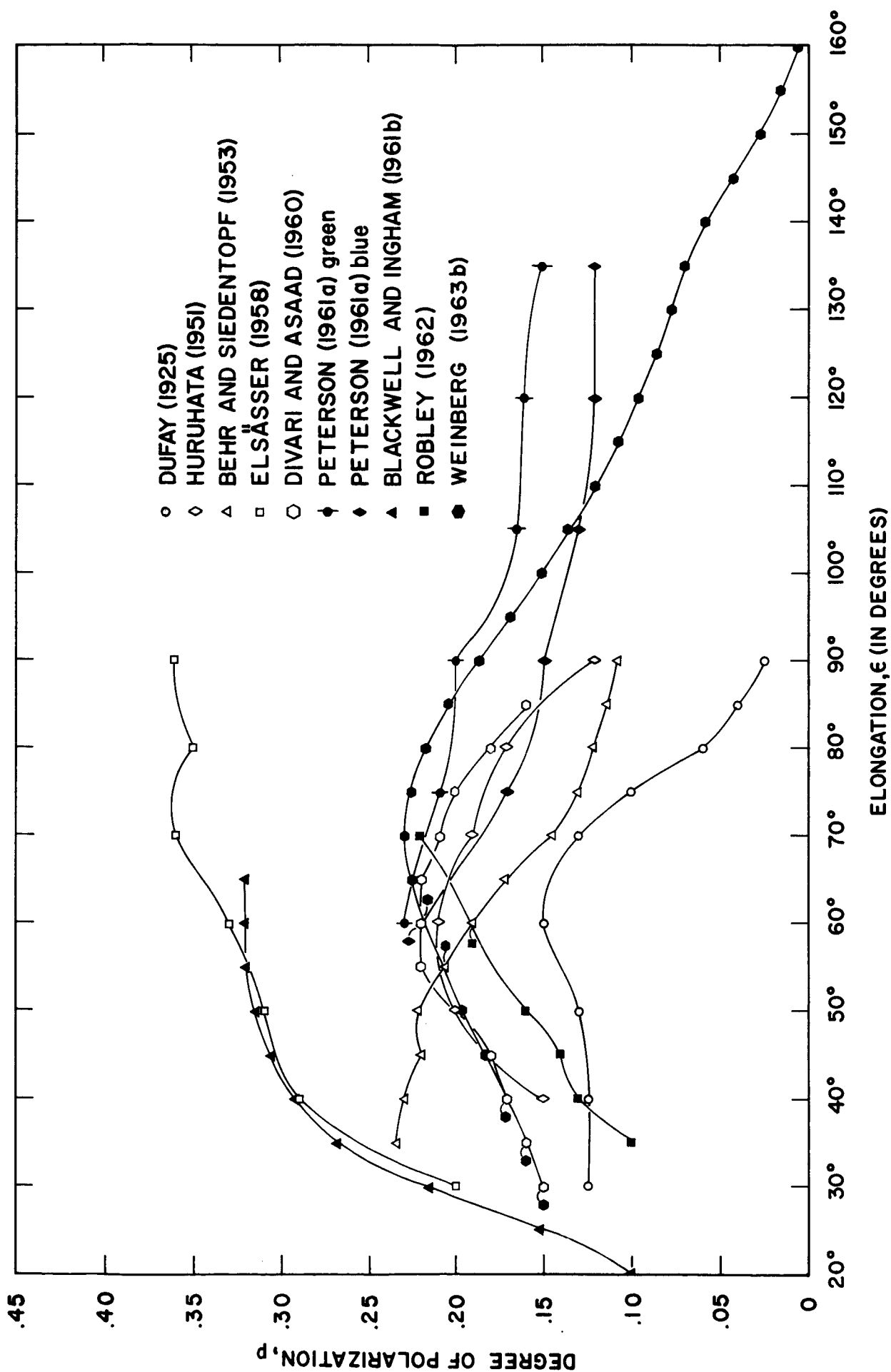


FIGURE 1. Representative post-1950 results for the surface brightness of the zodiacal light in the plane of the ecliptic (see p. 6).

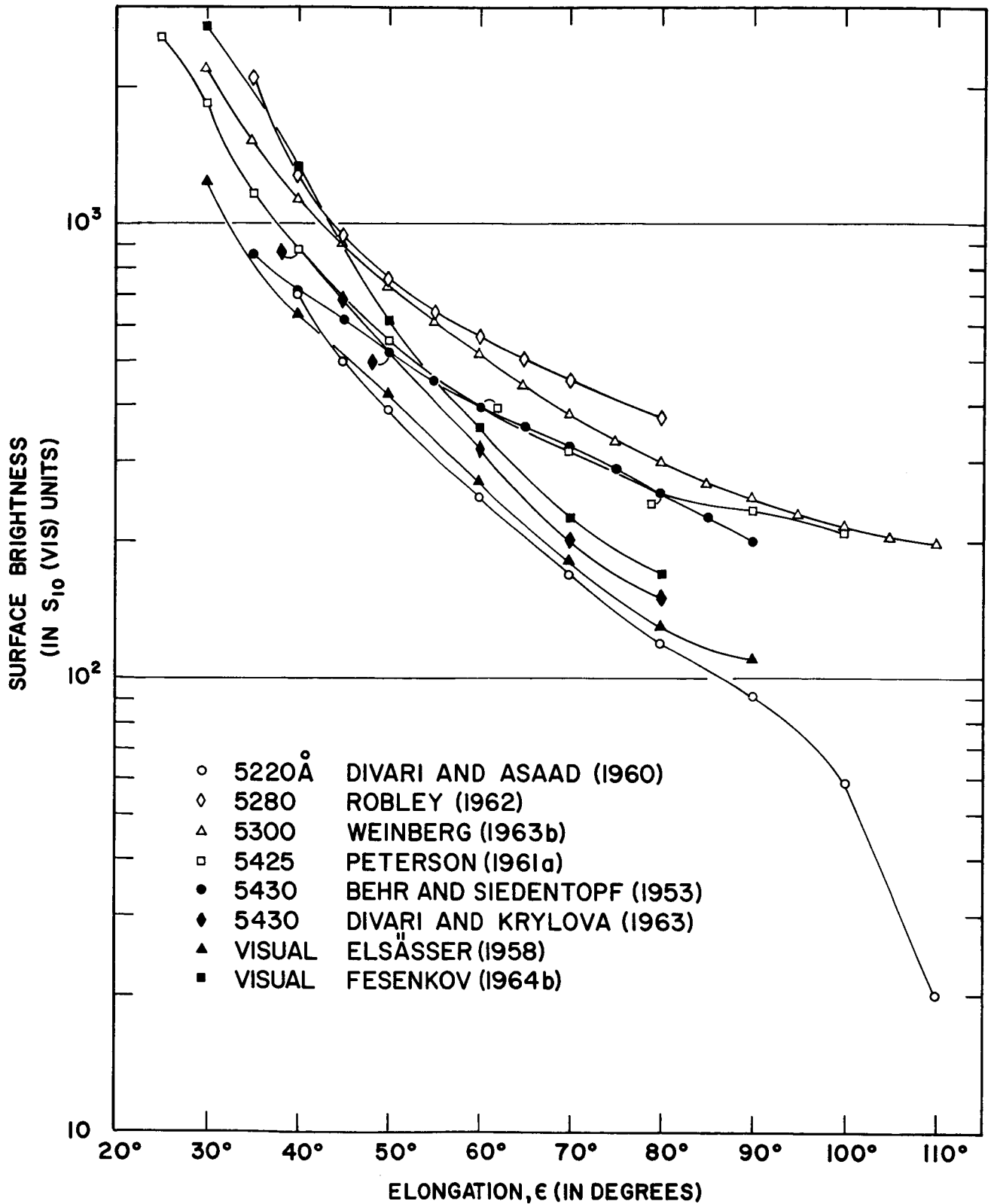


FIGURE 2. The degree of polarization of the zodiacal light in the plane of the ecliptic (see p. 6)

Author Legend

B	1955	Barbier
BE-S	1953	Behr and Siedentopf
BL	1956	Blackwell
BL-I	1961b	Blackwell and Ingham
D	1952	Divari
D-A	1960	Divari and Asaad
D-K	1963	Divari and Krylova
DU	1925	Dufay
DUM	1962, 1963a	Dumont
E	1958	Elsässer
E-S	1957	Elsässer and Siedentopf
F	1947, 1964b	Fesenkov
H	1930, 1932	Hoffmeister
HU	1951	Huruhata
KA	1961	Karyagina
LVR	1937	Elvey and Roach
P	1961	Peterson
REG	1955	Regener
RO	1962	Robley
RPTD	1954	Roach, Pettit, Tandberg-Hanssen, and Davis
R-RE	1956	Roach and Rees
T		Take-uchi
W	1963b	Weinberg
Y	1939	Yamamoto

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A Bibliography on Zodiacal Light and Gegenschein during the Triennium 1961-1964

This non-annotated bibliography is a compilation of zodiacal light and gegenschein references during the period January 1961 through June 1964 which were available to or known of by the author. Also included are papers on closely related problems which make use of zodiacal light results. It was not our intent to provide another bibliography on the closely-related topic of interplanetary matter, but we have included several references on this and other related subjects on the basis of our bias as to what should be included in such a bibliography.

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- Gillett, F. C., W. A. Stein, and E. P. Ney, 1964, Observations of the solar corona from the limb of the sun to the zodiacal light, July 20, 1963, Astrophys. J., (in press).