if the stellar magnetic field becomes increasingly chaotic toward maximum light, producing an effective disorientation of the polarizing grains. Alternatively, one might expect a reduction in the production of grains at maximum phase.

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## RADIO AND OPTICAL DATA ON TWELVE QUASI-STELLAR OBJECTS*

In a continuation of the work described in a previous letter (Bolton, Shimmins, J. Ekers, Kinman, Lamla, and Wirtanen 1966) radio and optical data are given for twelve new quasi-stellar objects. Finding charts for these objects are reproduced from the National Geographic–Palomar Sky Survey in Figure 1. The preliminary identifications by Bolton were confirmed by a comparison of radio-position measurements of high precision made with the Parkes telescope (Shimmins, Clarke, and Ekers 1966) with optical positions measured on first-epoch program plates taken with the Lick 20-inch astrograph. Additional confirmation was obtained for each object either from *UBV* photoelectric photometry or from double-exposure (blue and ultraviolet) direct photographs (cf. Ryle and Sandage 1964). Spectra were also obtained for eight of these objects.

The radio data are given in Table 1; it may be noted that a significant fraction of these objects have a low radio spectral index. The optical data are given in Table 2. The first symbol in the column labeled "UV Excess" denotes the quality of the observation: *A* for a photoelectric observation, *a* for a marked UV excess determined photographically, and *b* for a less marked excess determined photographically. The second symbol indicates the telescope used for the observation: 120 for the 120-inch reflector, Cr for the Crossley reflector, and K for a single observation with the Kitt Peak 84-inch reflector kindly made by Dr. E. J. Wampler. The photographic magnitudes ($m_{pg}$) in Table 2 are either rough estimates (to the nearest magnitude) from the Palomar Sky Survey prints or (if given to the nearest tenth of a magnitude) are derived from photoelectric observations made with the prime-focus photometer of the 120-inch reflector. Since these *UBV* photoelectric observations (see notes to Table 2) were single observations on one night for each object, the error in each color is perhaps of the order of $\pm 0.05$ mag.

Both *UBV* colors and redshifts (see notes to Table 2) are available for four of these objects. Two of these (1148−00 and 1354+19) have colors and redshifts that agree with the statistical relation between these quantities given in Figure 5 of a recent paper by

* *Contributions from the Lick Observatory*, No. 216.

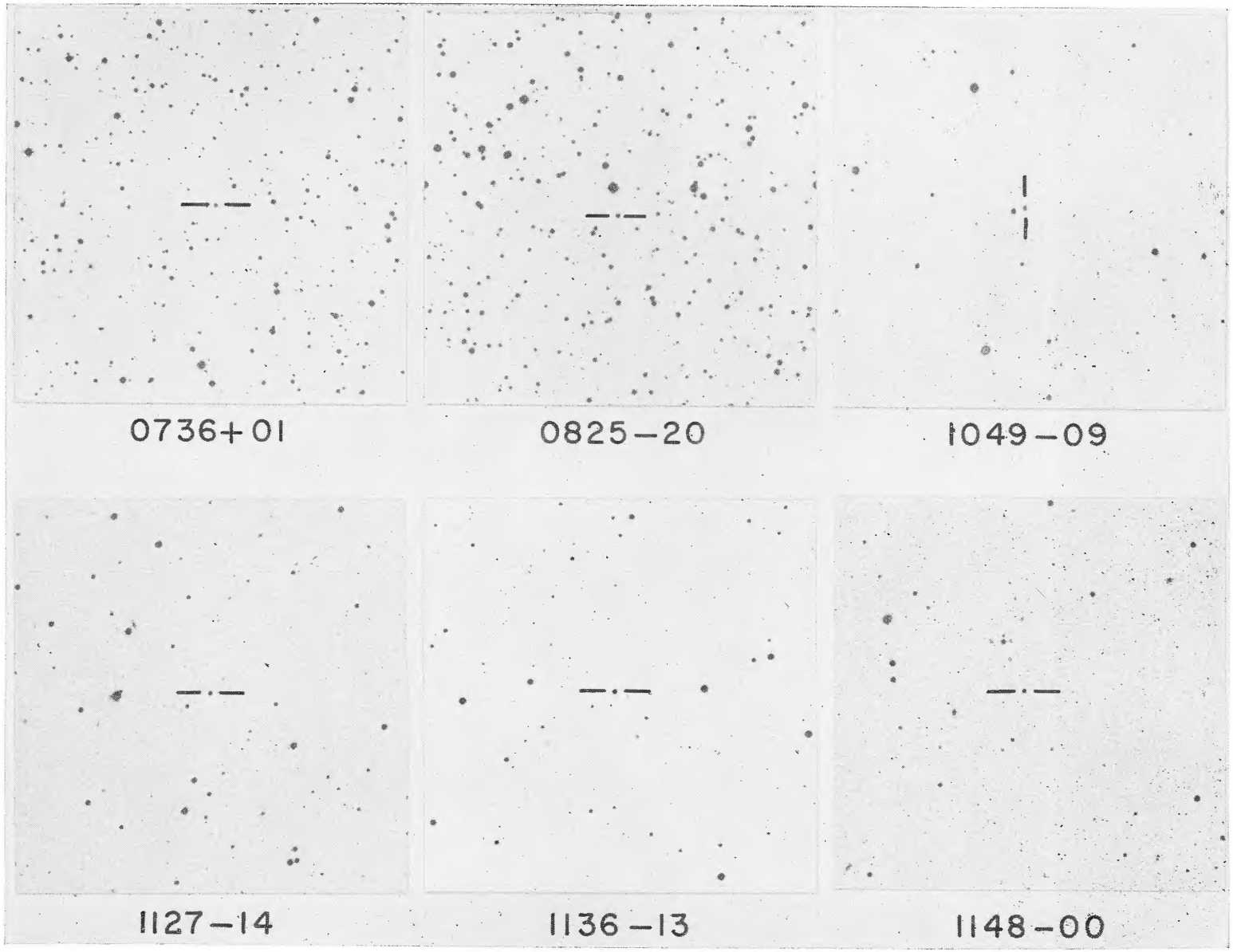


FIG. 1—Finding charts for the twelve quasi-stellar objects which are indicated between the two bars. Each chart is of side 10′; north is to the top and east to the left.

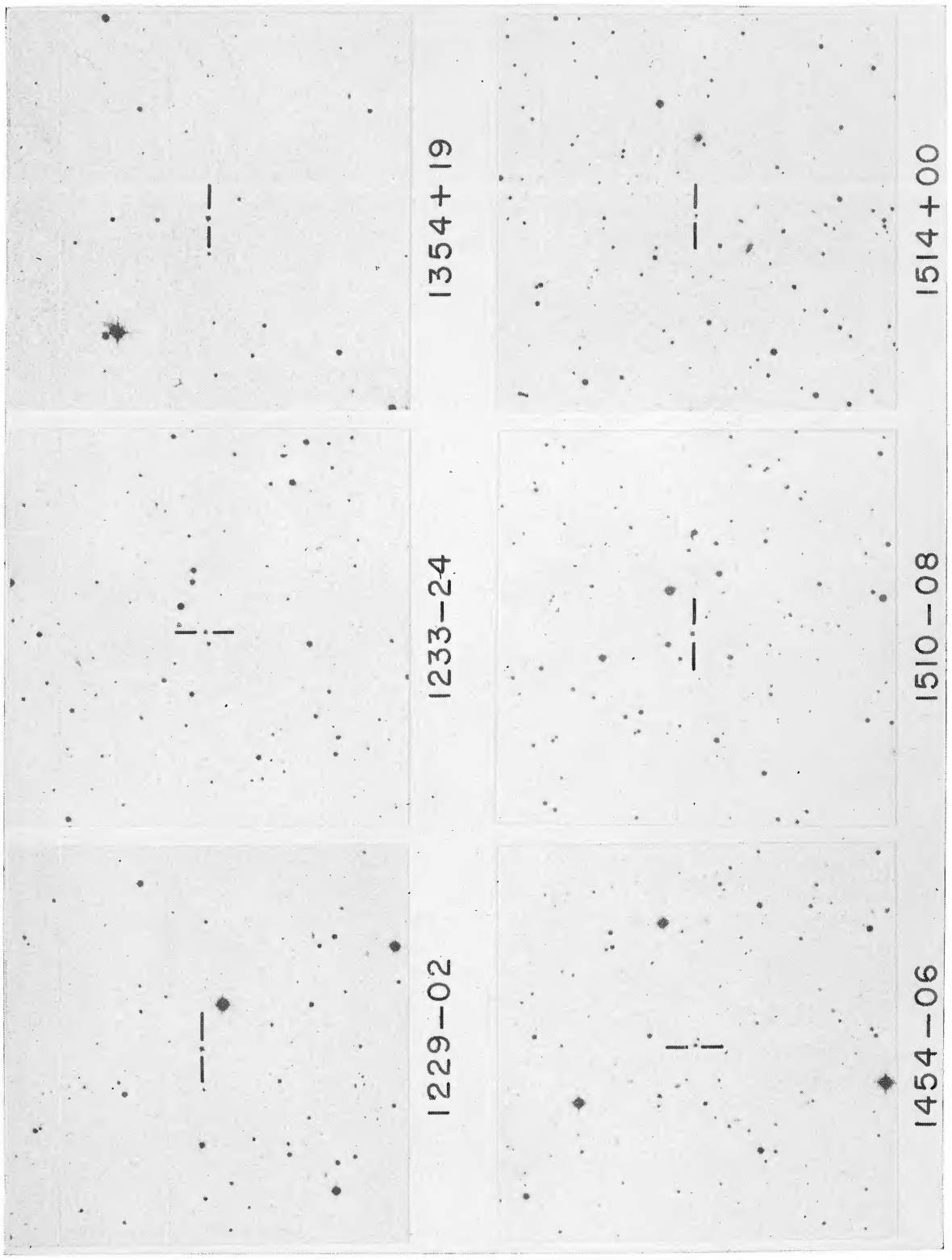


FIG. 1.—*Continued*

TABLE 1

RADIO DATA

| CATALOGUE No. | ALTERNATE CATALOGUE NOS. | RADIO POSITION (1950) | | FLUX DENSITY AT 1410 MC/S | SPECTRAL INDEX |
|---|---|---|---|---|---|
| | | $\alpha$ | $\delta$ | | |
| 0736+01 | | $07^h36^m43^s.0 \pm 0^s.6$ | $+01°44'00'' \pm 7$ | 2 9 | * |
| 0825−20 | 08−*24* | 08 25 04 0±0 6 | −20 16 24 ± 6 | 3.7 | −0 8 |
| 1049−09 | 10−*019* | 10 48 59.6±0 9 | −09 02 24 ±12 | 1 9 | −0 8 |
| 1127−14 | | 11 27 36 3±0 9 | −14 32 53 ±11 | 7 0 | −0 1 |
| 1136−13 | 11−*18* | 11 36 37 8±0 5 | −13 34 08 ±10 | 4 6 | −0 6 |
| 1148−00 | | 11 48 10 4±0 9 | −00 07 10 ±11 | 3 3 | −0 1 |
| 1229−02 | | 12 29 27 1±0 9 | −02 07 35 ±11 | 1 9 | −0 5 |
| 1233−24 | 12−*27* | 12 32 59 1±0 7 | −24 55 44 ± 7 | 2 3 | −0 9 |
| 1354+19 | | 13 54 41 5±0 9 | +19 33 29 ± 9 | 2 3 | −0 7 |
| 1454−06 | 14−*018* | 14 54 03 8±1 1 | −06 05 31 ±14 | 1 4 | −0 8 |
| 1510−08 | | 15 10 09.0±1 0 | −08 54 51 ± 9 | 3 4 | −0 1 |
| 1514+00 | | 15 14 14 ±2 | +00 26 06 ±30 | 2.5 | −0.6 |

* A curved spectrum.

TABLE 2

OPTICAL DATA

| CATALOGUE No. | OPTICAL POSITION (1950) | | OPTICAL MINUS RADIO POSITION | | | UV EXCESS |
|---|---|---|---|---|---|---|
| | $\alpha$ | $\delta$ | $\Delta\alpha$ | $\Delta\delta$ | $m_{pg}$ | |
| 0736+01 | $07^h36^m42^s.4 \pm 0^s.14$ | $+01°43'57'' \pm 1''.9$ | $-0^s.6$ | −03″ | 18 | *a*K |
| 0825−20 | 08 25 03 4±0.25 | −20 16 31 ±2.1 | −0 6 | −07 | 18 | *a*120 |
| 1049−09* | 10 48 59 5±0 18 | −09 02 12 ±1 8 | −0 1 | +12 | 16 8 | *A*120 |
| 1127−14† | 11 27 35 6±0 07 | −14 32 57 ±1 9 | −0 7 | −04 | 17 2 | *A*120 |
| 1136−13‡ | 11 36 38 6±0 18 | −13 34 09 ±2 0 | +0 8 | −01 | 17 | *a*120 |
| 1148−00§ | 11 48 10 2±0 13 | −00 07 15 ±1 3 | −0.2 | −05 | 17 8 | *A*120 |
| 1229−02‖ | 12 29 25 9±0.15 | −02 07 31 ±1 9 | −1 2 | +04 | 17 2 | *A*120 |
| 1233−24 | 12 32 59 4±0 09 | −24 55 46 ±2 5 | +0 3 | −02 | 17 | *b*120 |
| 1354+19# | 13 54 42.3±0.28 | +19 33 41 ±2 1 | +0 8 | +12 | 16 2 | *A*120 |
| 1454−06** | 14 54 02.7±0 12 | −06 05 45 ±0 9 | −1 1 | −14 | 18 6 | *a*Cr |
| 1510−08†† | 15 10 08 9±0 25 | −08 54 48 ±2 2 | −0 1 | +03 | 16 7 | *a*120 |
| 1514+00 | 15 14 14.8±0 06 | +00 26 01 ±1 7 | +0 8 | −05 | 19 | *b*Cr |

* $V = 16\ 79$, $B - V = +0\ 06$, $U - B = -0\ 49$ (JD 2439230); spectrum (120 inch)

† $V = 16\ 90$, $B - V = +0\ 27$, $U - B = -0\ 70$ (JD 2439230); redshift = 1 187 (Burbidge and Kinman 1966)

‡ An intensity tracing (with the night-sky component subtracted) of a spectrum taken with the prime-focus image-tube spectrograph (Burbidge and Kinman 1966) shows weak features may be present at approximately the following wavelengths: 4900 Å (broad, ill-defined), 5893 Å (sharp), 6020 Å (sharp), and 6025 Å (very weak and medium width) These features may be identified with Mg II λ 2798, [Ne V] λ 3346 and λ 3426, and [O II] λ 3727, respectively, with a redshift of 0 759 The computed rest wavelengths are then λ 2786, λ 3350, λ 3422 and λ 3709, respectively. The discrepancies between the true and computed rest wavelengths and the unusual weakness of the feature identified as Mg II λ 2798 make these identifications and the redshift quite uncertain.

§ $V = 17\ 60$, $B - V = +0\ 17$, $U - B = -0\ 97$ (JD 2439230); redshift = 1 982 (Burbidge and Kinman 1966)

‖ $V = 16\ 75$, $B - V = +0\ 48$, $U - B = -0\ 66$ (JD 2439230); spectrum (120 inch)

# $V = 16\ 02$, $B - V = +0.18$, $U - B = -0\ 55$ (JD 2439230); redshift = 0 720 (Burbidge and Kinman 1966)

** $V = 18\ 0$, $B - V = +0\ 6$ (JD 2439290); redshift = 1 249 (Burbidge and Kinman 1966)

†† $V = 16\ 52$, $B - V = +0\ 17$, $U - B = -0\ 74$ (JD 2439230); redshift = 0 361 (Burbidge and Kinman 1966)