A TRIAXIAL FIGURE OF JUNO INFERRED FROM OCCULTATION AND LIGHTCURVE DATA. A. W. Harris, J.P.L., Pasadena, CA 91103.

The asteroid 3 Juno was observed to occult the star AGK 3 +0 1022 on 11 December, 1979 at approximately 9:10 UT. The event was successfully observed from five JPL sites, four of them photoelectric. The results of these observations are summarized in Table 1. The best fit elliptical cross-section of the asteroid is shown in Figure 1. The one visual observation (N. Little Lake, open circles in Figure 1) was not included in the formal solution, but is plotted to show that the computed figure is compatible with the visual observation.

The computed ellipse has the following dimensions:

Major axis = 291 km,
Minor axis = 238 km,
Position angle of minor axis = 348°.

The above fit of the observations to an elliptical cross-section was kindly

![Figure 1](image)

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>N. LATITUDE</th>
<th>W. LONGITUDE</th>
<th>IMMERSION</th>
<th>EMISSION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Joshua Tree</td>
<td>34°06'01&quot;</td>
<td>116°15'55&quot;</td>
<td>9:09:53.80</td>
<td>9:10:36.82</td>
</tr>
<tr>
<td>Table Mt.</td>
<td>34°22'54&quot;</td>
<td>117°40'51&quot;</td>
<td>9:10:04.20</td>
<td>9:11:11.73</td>
</tr>
<tr>
<td>Stoney Ridge</td>
<td>34°17'55&quot;</td>
<td>117°59'45&quot;</td>
<td>9:10:11.3</td>
<td>9:11:18.6</td>
</tr>
<tr>
<td>Mohave</td>
<td>35°07'35&quot;</td>
<td>118°03'22&quot;</td>
<td>9:10:03.20</td>
<td>9:11:07.00</td>
</tr>
</tbody>
</table>
| N. Little Lake | 36°02'56"   | 117°56'23"  | 9:10:12     | 9:10:43
FIGURE OF JUNO

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provided by R. Millis and L. Wasserman, Lowell Observatory. They also note (private communication, 1979) that this solution is substantially in agreement with solutions including observations from other sites.

In addition to observing the occultation itself, 3 Juno was observed photoelectrically on five other nights before and after the event to measure the lightcurve at the occultation aspect and to determine the rotational phase at the moment of occultation. These results are summarized in the composite lightcurve, Figure 2. The period of rotation deduced from these observations is:

\[ P = 7^h 210 \pm 0^h 001 \]

The rotation phase at the moment of occultation is indicated by "OC." in Figure 2.

Photoelectric lightcurves of 3 Juno have been reported from 1954 (1), 1958 (2), and 1961 (3), in addition to the present observations. The amplitude of variation vs. Right Ascension of these observations is plotted in Figure 3. (All observations are at Declinations of <10°, hence the analysis

FIGURE 2.

FIGURE 3.

is done with respect to the earth's equatorial plane.) Since Juno exhibits the same amplitude of variation when viewed at a substantial range of aspects, one can conclude that the pole of Juno is nearly perpendicular to the plane containing the directions to Juno of the observations, which in this case is approximately the earth's equatorial plane. The small tilt of the elliptical cross section observed by occultation also indicates a low obliquity. Hence, we conclude that Juno's rotation axis is nearly parallel to the earth's. It should be noted, however, that an object viewed from its rotational equator
must exhibit precisely the same cross-section at rotation phases 180° apart from one another. Therefore, the considerable asymmetry of the two maxima and minima of Juno's lightcurve must be interpreted as indicating some obliquity of the rotational equator to the observation plane, or as due to albedo or shadowing effects which do not repeat on opposite hemispheres. The fact that the lightcurve does not have exactly the same shape at all of the previously observed aspects requires at least some tilt of the rotation axis.

Based on the assumption that the obliquity is small (≤20°), which seems justified on the basis of Figure 3, and assuming no longitudinal variation of albedo, we estimate the ratio of lengths of the two equatorial axes to be 1:1.12, with considerable higher order deviations of the figure (≤5%) required to produce the observed lightcurve asymmetry. Since the occultation occurred at a rotation phase very nearly half way between maximum and minimum light, the two equatorial axes are a ≈ 308 km and b ≈ 274 km. The polar axis remains close to the observed minimum, 238 km.

The direct measure of Juno's diameter can be compared with that determined indirectly, D = 249 km, as reported by Bowell et al. (4). Since Juno is always seen near equatorial aspect, the mean diameter of the elliptical figure is essentially that which was observed at the moment of occultation, or D ≈ 263 km. The discrepancy of only 5% can be considered negligible in view of the uncertainties involved.

ACKNOWLEDGEMENTS

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REFERENCES