THE ORBITAL EVOLUTION OF COMET BOWELL (1980b)

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Abstract. Planetary perturbations and orbital evolution of the elements of the comet Bowell (1980b) are calculated. The sudden change of all the elements of the orbit on February 1981 is caused by Jupiter's perturbation.

The comet Bowell (1980b) is very interesting for the highly hyperbolic character of the orbit (Marsden, 1981), (Hasegawa et al., 1981); for this reason in a previous short communication (Buffoni et al., 1981) we have calculated the orbital elements of this comet from 68 observations during the interval February 11, 1980 to June 6, 1981 (Table I) and we have seen that Jupiter has a very strong perturbation effect on February 1981.

The disturbing forces that the individual planets exert on Bowell comet appears on the graph of Figure 1 where R is the ratio between the modules of solar attraction force and the perturbing force plotted with the time on logarithmic scale from 2440 750.5 JD to 2445 750.5 JD. From this diagram it is possible to see that the maximum of the attraction force of Jupiter is about 50% of that of the Sun.

Figure 2 shows the projection of the orbits of Jupiter and of the comet into the ecliptic plane for an interval of 400 days around the epoch of approach to Jupiter. The positions of the comet and of Jupiter are given for corresponding epochs every 20 days starting from March 22, 1980 to April 26, 1981. To avoid confusion we have not drawn in the figure the correspondent positions around the epoch of orbit crossing (October 28, 1980, November 17, 1980 and December 7, 1980).

The evolution of the individual orbital elements within the interval from July 11, 1978 to June 15, 1983 is plotted in Figure 3. All sudden changes of the elements are due to close approach to Jupiter.

As can be seen the inclination decreases from the maximum value 1°.7787 to a constant minimum of 1°.6649. The longitude of the ascending node shows a similar trend passing from the maximum value 120°.1656 to the minimum of 114°.0693. The argument of perihelion shows an initial descent to 133°.7646 then rises steeply reaching a constant maximum of 134°.9022. The \( \log_{10} \frac{q}{(e - 1)} \) exhibits a sudden decrease reaching the minimum value of about 1.6702 AU then increases and the value becomes nearly constant (1.7736 AU). The perihelion distance rises steeply from a minimum of 3.184 115 6 AU to a constant maximum of 3.364 814 5 AU. The time of perihelion passage start with the
Fig. 1. Planetary perturbations on Bowell's comet.