Orbital dynamics of highly probable but rare Orionid outbursts possibly observed by the ancient Maya

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Until recently there had been no evidence for the observation of meteors in the pre-Hispanic western hemisphere. In a previous first-of-its-kind study using orbital integrations (Kinsman and Asher, 2017, Planet. Space Sci.), we linked computed eta Aquariid outbursts with certain events recorded in inscriptions during the Maya Classic Period, AD 250--900. Now, in a new application of orbital dynamics to historical astronomy, we investigate outbursts of the Orionids (twin shower of the eta Aquariids) by integrating particles released at Comet Halley's returns from 1404 BC to 240 BC. Again the aim is to correlate events already recorded in the inscriptions in `target' years during the Maya Classic Period to those probable outbursts. Significant probable outbursts are found in AD 417 and 585, out of 30 possible target years. The outbursts are from particles ejected in 1266 BC and 911 BC. A significant difference between the two showers is that orbital precession brought Comet Halley's descending node (corresponding to the eta Aquariids) to Earth intersection during the 1st millennium AD, whereas the ascending node (corresponding to the Orionids) was near the Earth's orbit around 800 BC. In order to produce these Orionid outbursts, a strong dynamical effect is therefore required so that the meteoroids' orbital precession differs hugely from that of the parent comet. The dynamical driving mechanisms turn out to be Jovian 1:6 and 1:7 mean motion resonances acting to maintain compact structures within the Orionid stream for over 1 kyr. Sato and Watanabe (2007, PASJ) showed that resonant meteoroids released by Halley in 1266 BC and 911 BC can have precession slowed so much as to produce Orionid outbursts even in the current epoch. In addition to correlating with the Maya records, we confirm an Orionid outburst in AD 585 recorded in China.