

Long Term Evolution of Comet Halley & the Orionid Stream

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NAM 2012, Manchester

Brief Introduction to History of Comet 1P/Halley

- * Observational records date back to 240 B. C. (Yeomans & Kiang 1981)
- Accurate orbital elements from 1404 B. C. (Yeomans & Kiang 1981)
- Physical life-time assumed to be about 200 revolutions (Whipple 1951)
- * Dynamical life time of the order of 100,000 years (Hughes 1985, Hadjuk 1986, Steel 1987, Emel'yanenko & Bailey 1996)



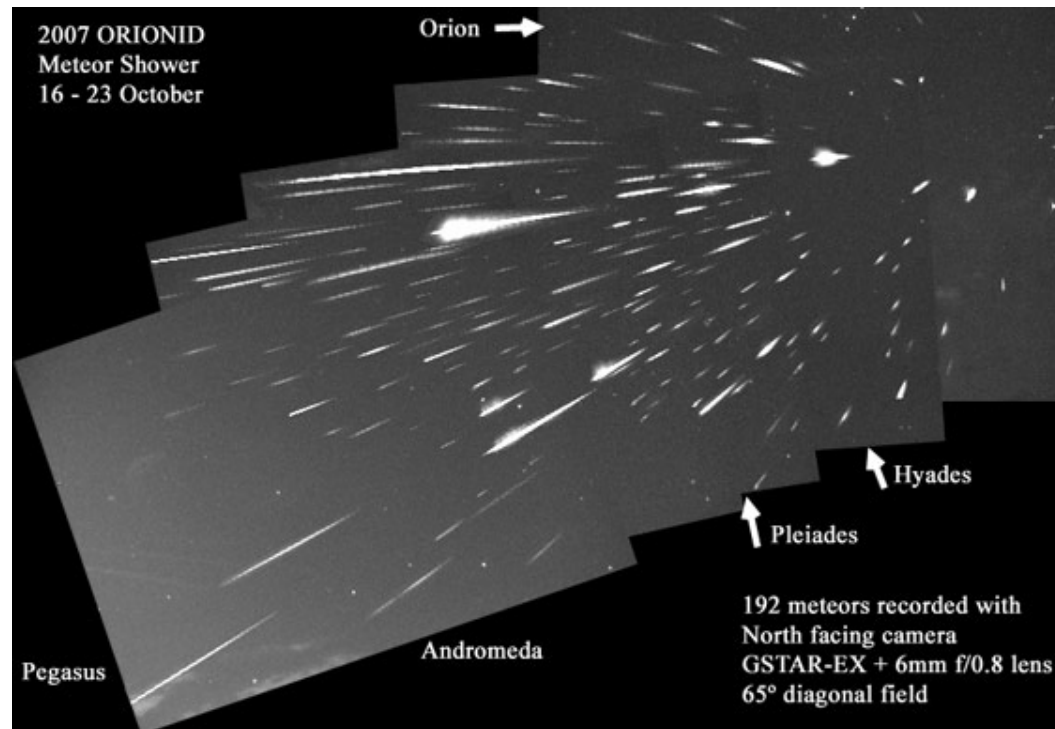
(Credit: W. Liller, International Halley Watch, 8 March 1986)



(Credit: H. U. Keller)

Brief Introduction to the Orionids Shower

- Orionids outburst in 2006 was unexpected
- * Previous works explained this outburst from 2006-2010 using 1:6 resonance mechanism with Jupiter (Rendtel 2007, Sato & Watanabe 2007)



(Credit: S. Quirk)

Our Present Work

- Halley itself was 1:6 resonant from about 1404 B.C. to 690 B.C.

- * Halley itself was 2:13 resonant from about 240 B.C. to 1700 A.D.

- Our calculations show that the favourable conditions for 1:6 and 2:13 resonance are:

- A restricted range in semi-major axis

- High eccentricity

- * Near ecliptic inclination, for all of which Halley is a perfect candidate !

- Observational records show an Orionid outburst in 1993 (Rendtel 1993)

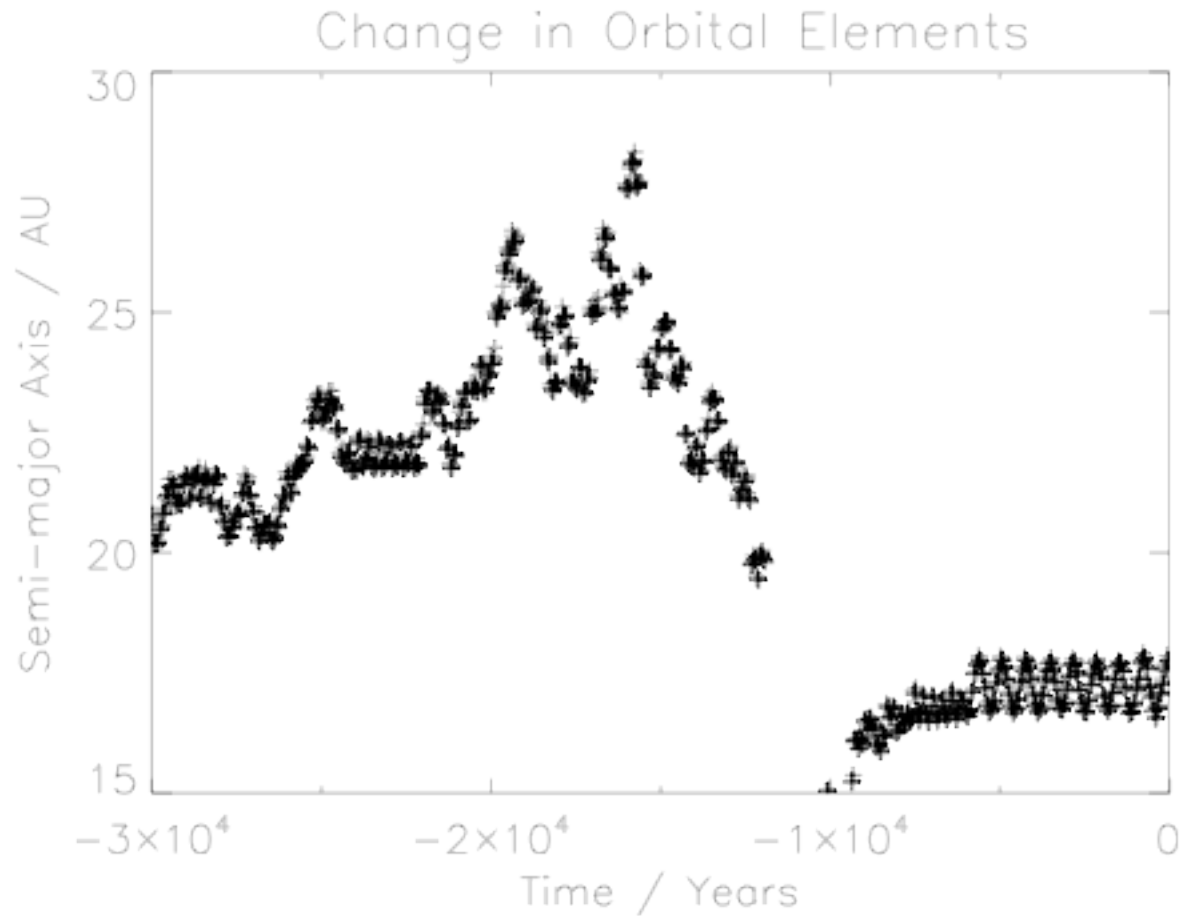
- Our calculations show that it could be due to 2:13 resonance with Jupiter

- Historical records also show a hint of enhanced meteor rates in 1916 (Olivier 1921) and 1839 (Herrick 1839).

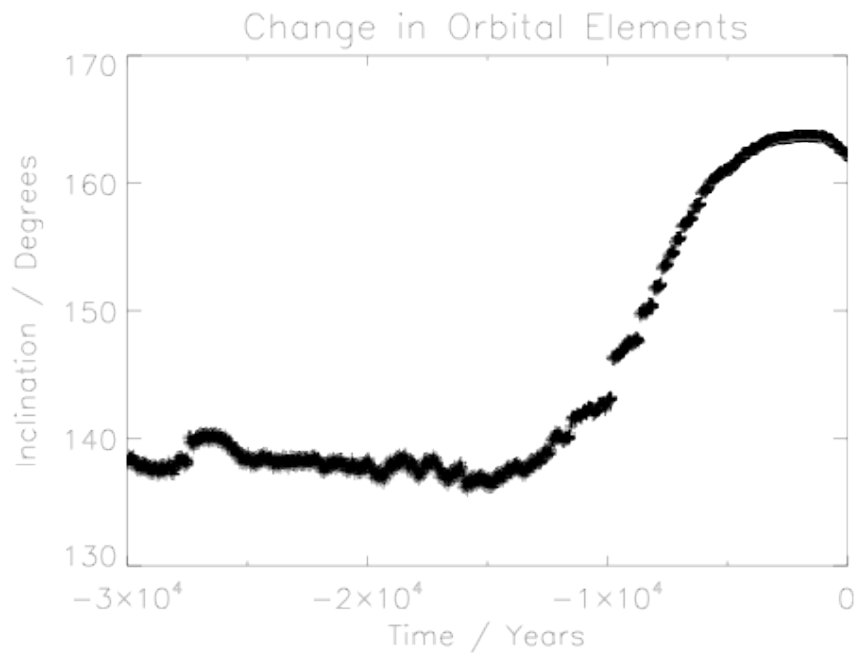
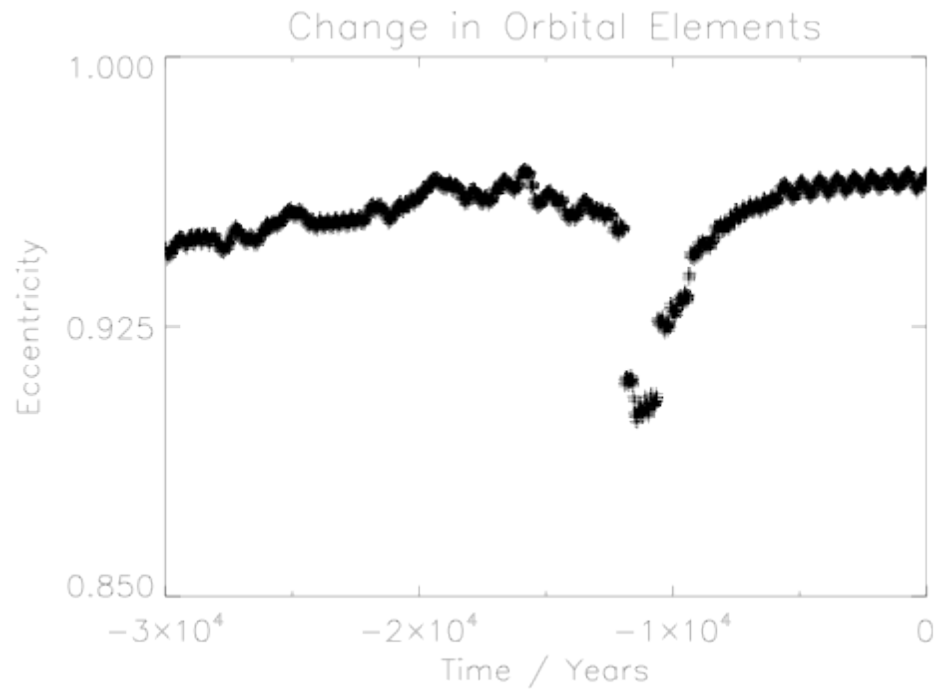
- * We expect a similar outburst in 2070.

History of Comet's Orbit

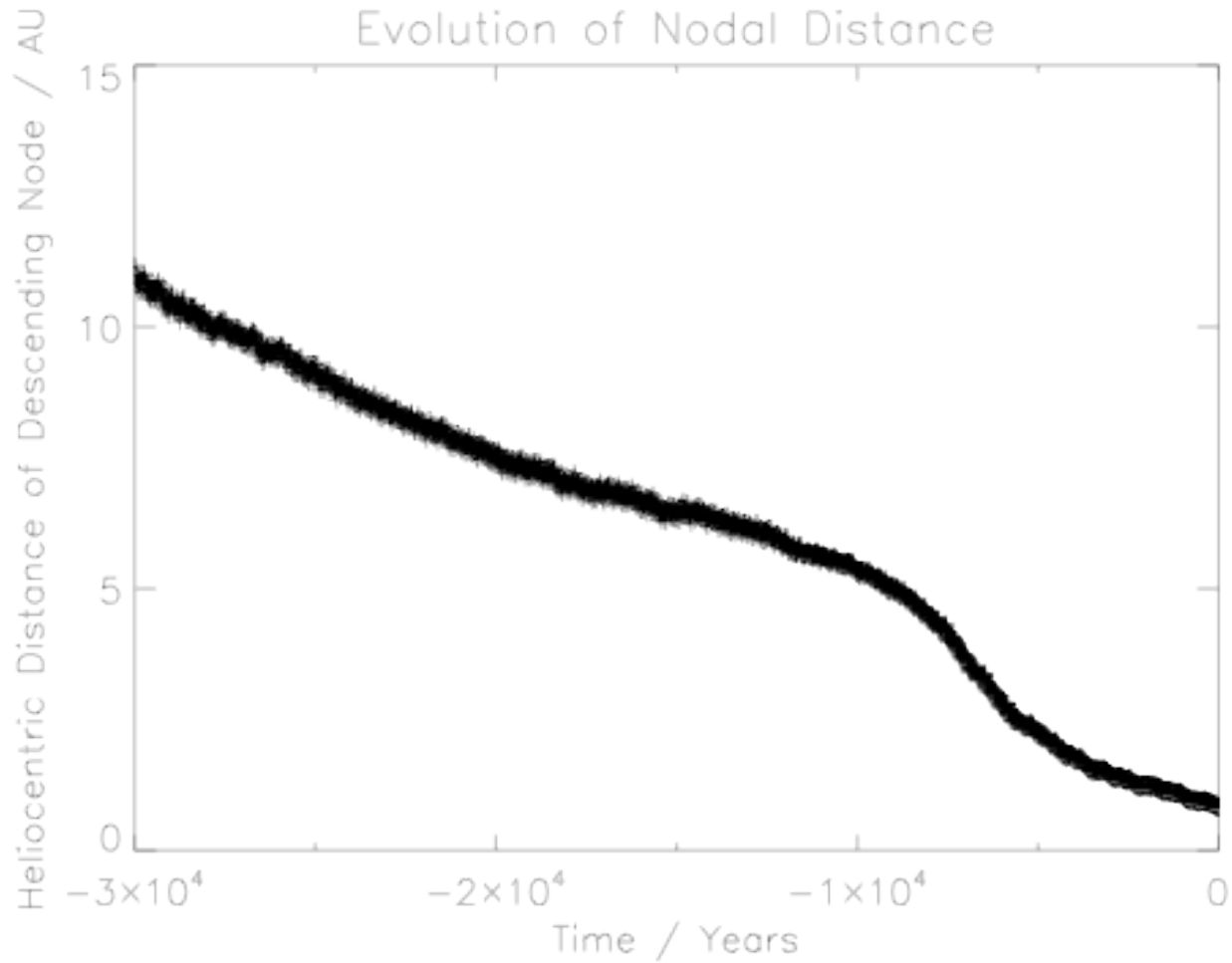
- Halley's orbit was substantially different about 12,000 years back



Starting epoch here is 240 B.C.

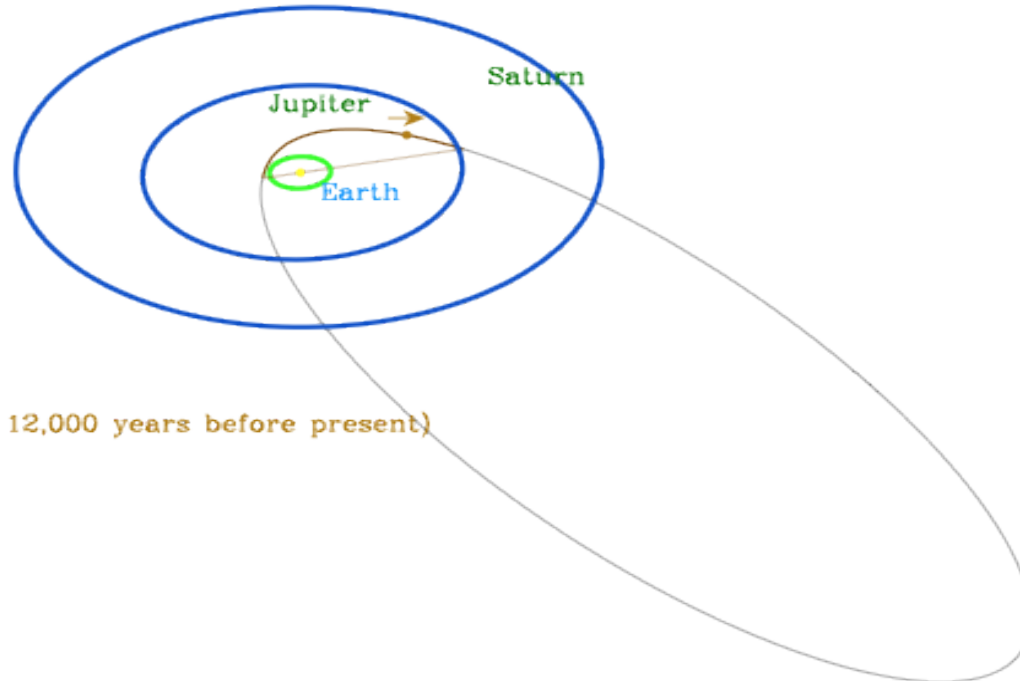


* This drastic change in orbit was due to close encounters with Jupiter



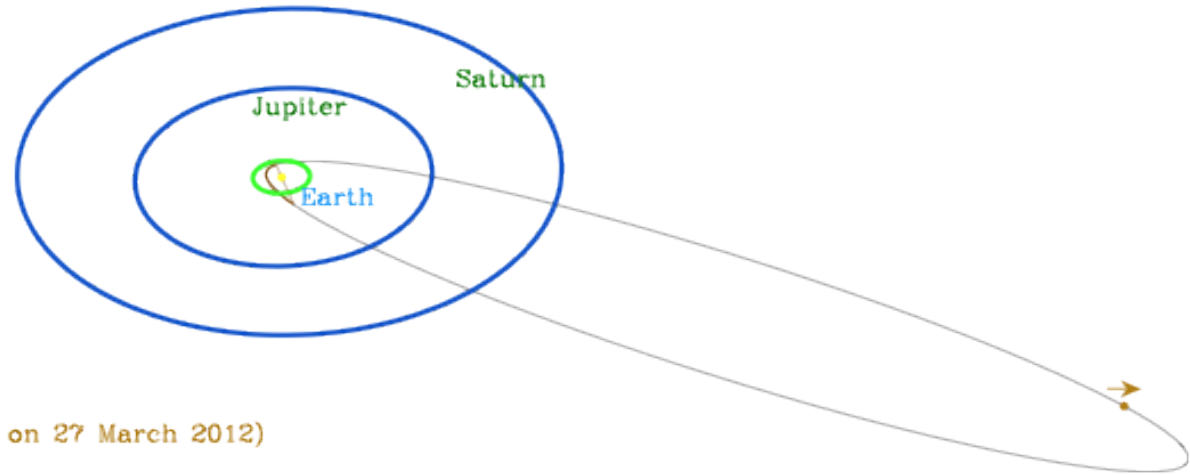
Starting epoch is 240 B.C.

Orbit positions 12,000 years back



(Orbit 12,000 years before present)

Present Orbit



(Orbit on 27 March 2012)

Intended Future Work

- To develop an ejection model to populate meteoroids from 12,000 years in the past
- To track them forward in time and correlate with the present observations if possible
- Further more our initial tests show that many (14 out of 27 bodies near this semi-major axis range) other solar system bodies also exhibit 1:6 and 2:13 resonance
- * Would be interesting to look into the dynamics of some of them as well

Enough of interesting open problems to keep anyone occupied
till 2061 (next apparition of Halley) ☺

THANK YOU

