Update on recent-past and near-future meteor shower outbursts on Earth and on Mars

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4 - Armagh Observatory, N.Ireland, UK
5 - Ondrejov observatory, Czech Republic
6 - Comenius University, Slovakia

Outline

- (almost exhaustive) Introduction to the dynamics of meteoroids
- The 2014 Camelopardalids
- C/2013 A1 at Mars in Oct 2014
- How to perform the forecasting of meteor showers?

Meteors vs meteoroid stream

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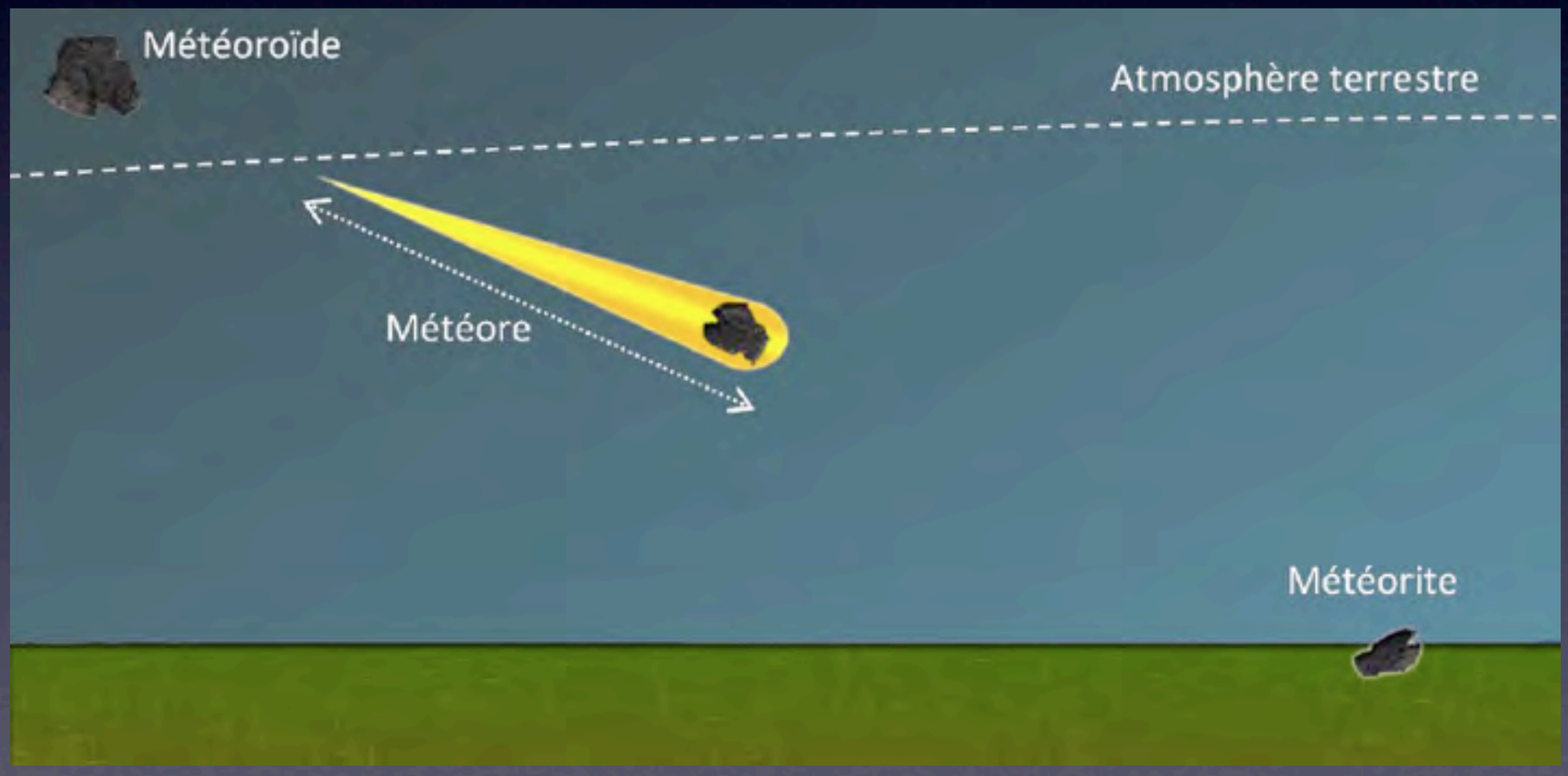

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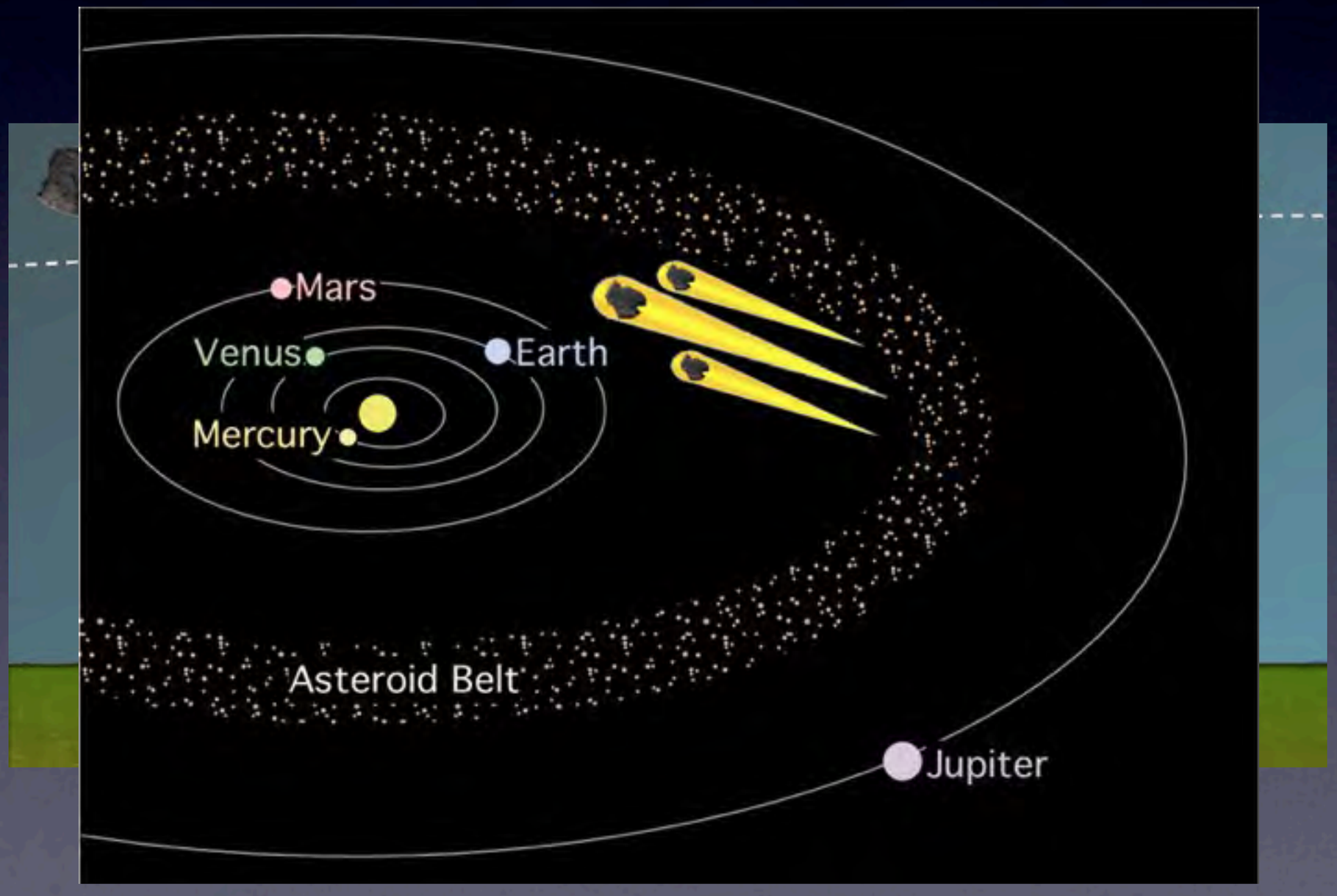

Orbits

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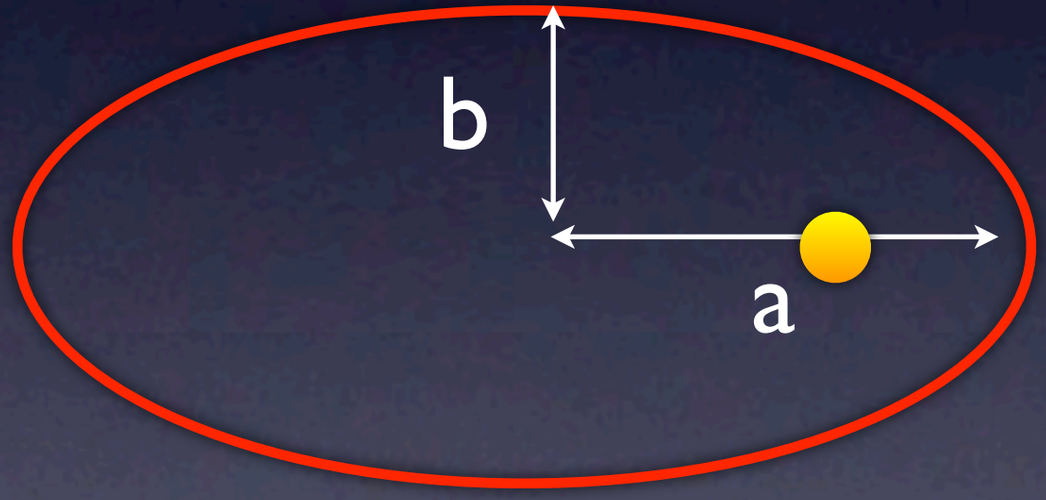

e=b/a

Orbits

Orbits

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Orbits

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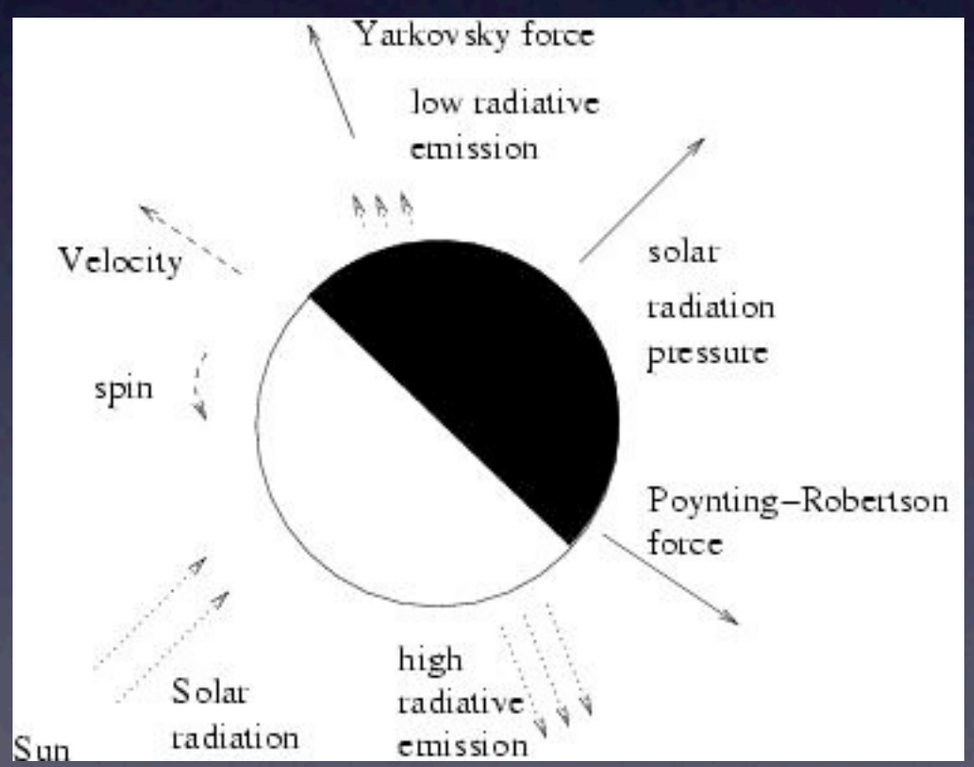
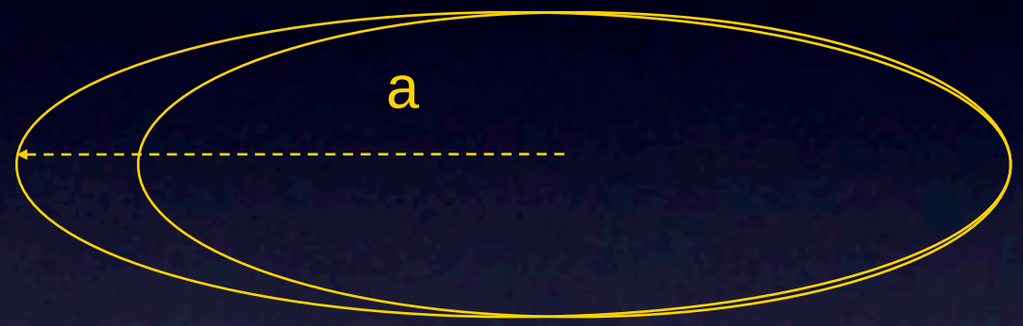
Orbits

Close encounters, resonances

Non gravitational forces



Simulations



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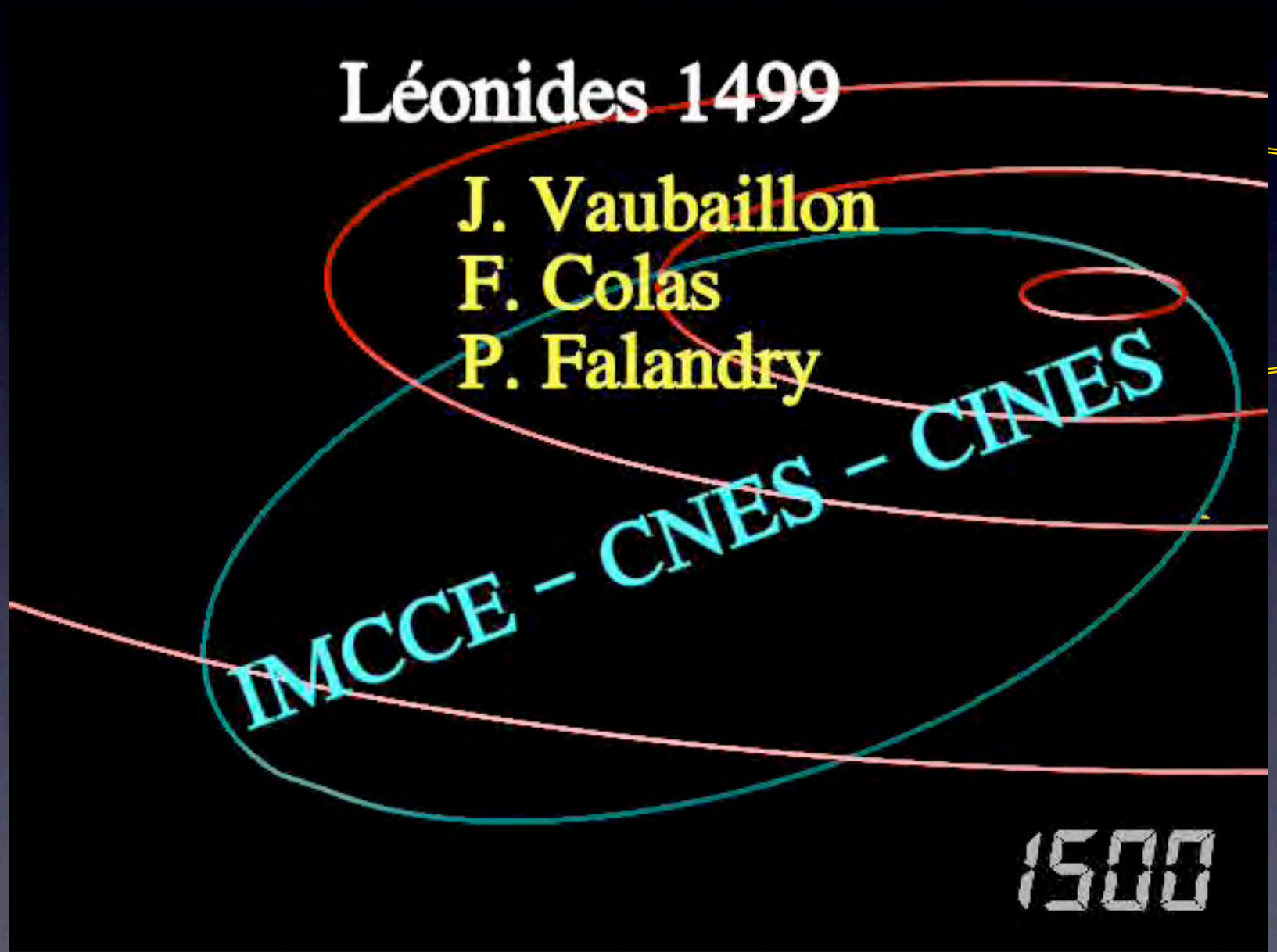

Consequences at Earth

Perseids

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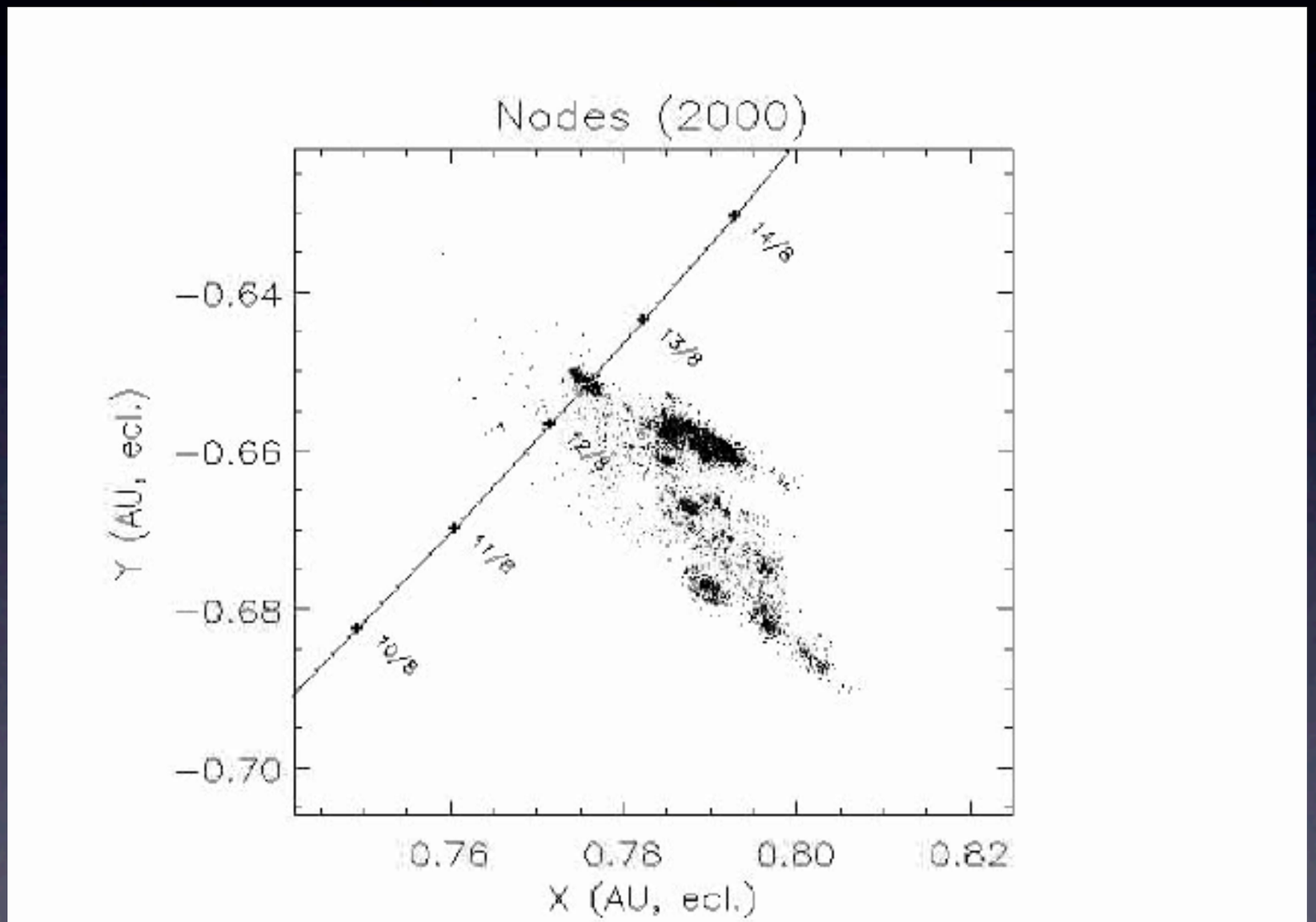
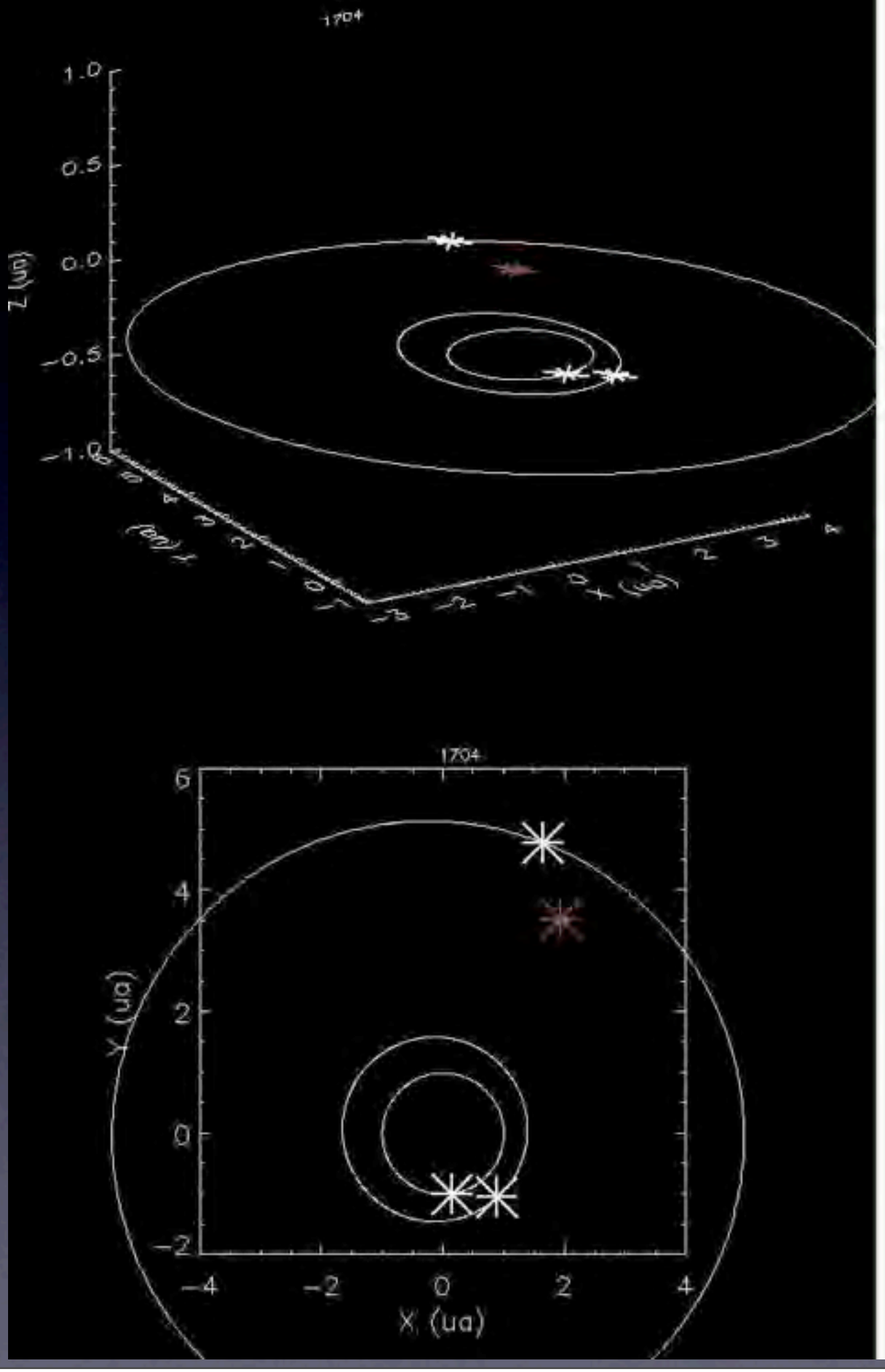


Perseids

Jupiter family streams


1704
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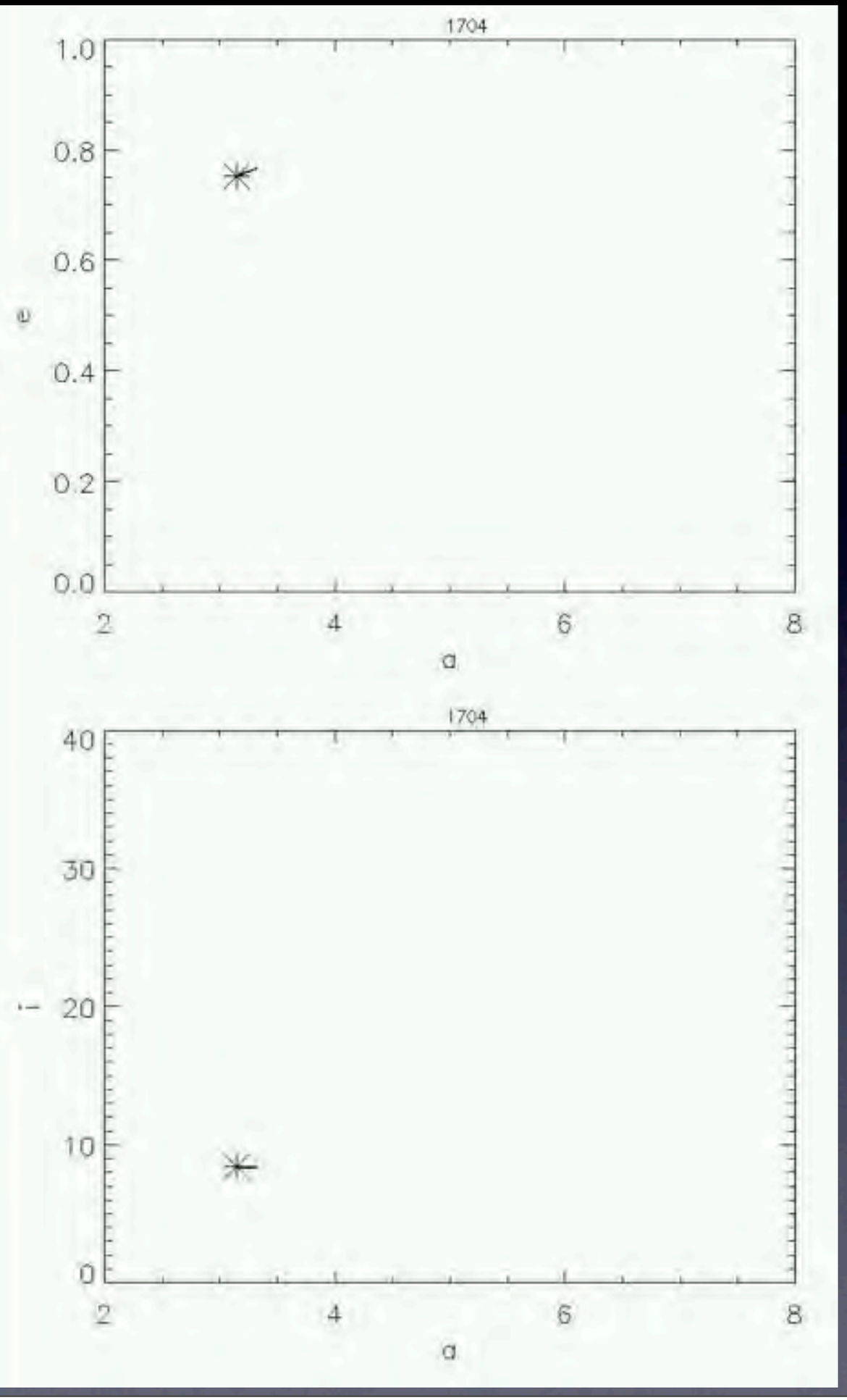
−1.0
Z (ua)
Y (ua)
X (ua)


1704
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e
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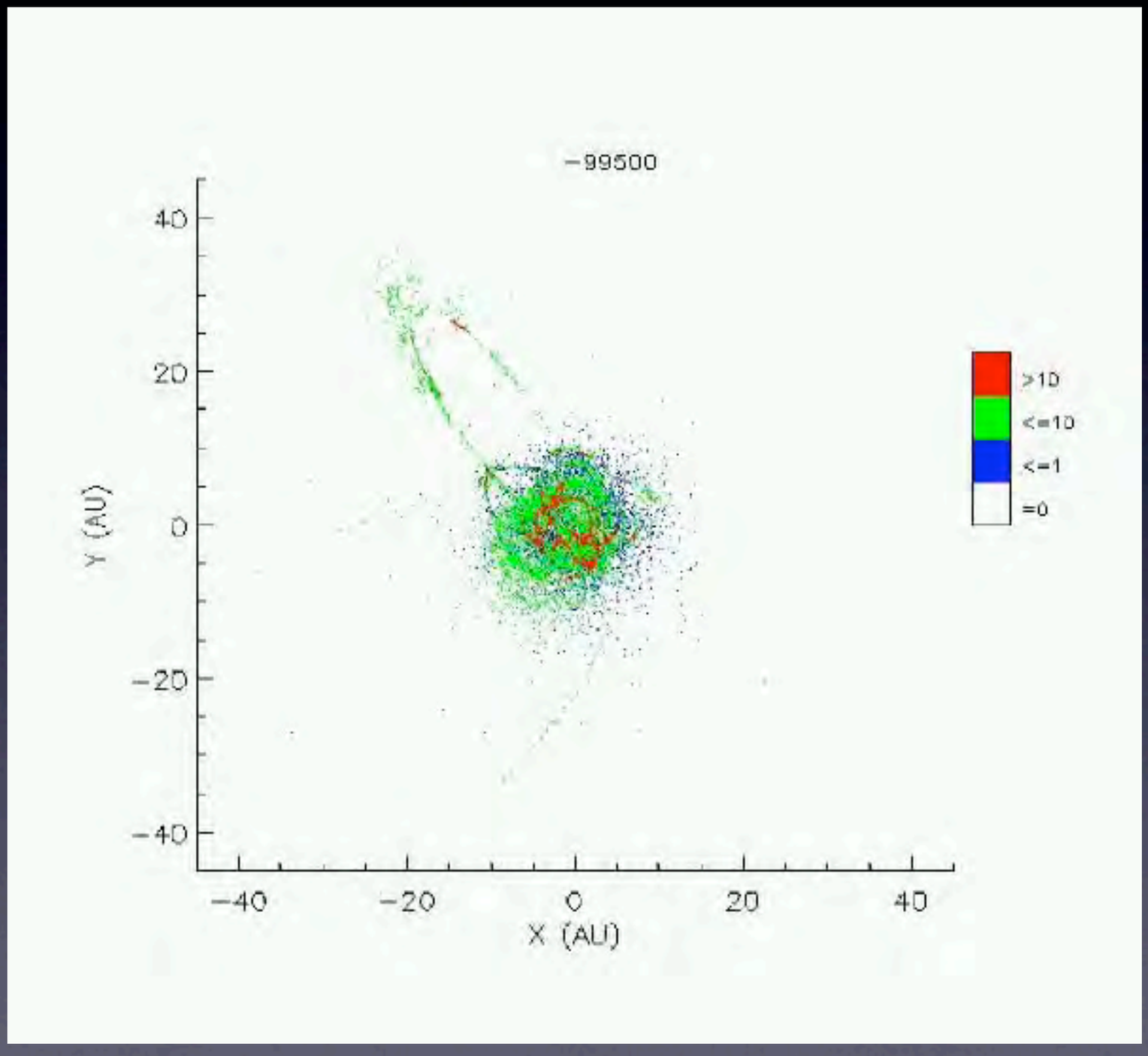
Sporadic meteors



Wiegert, Vaubaillon, Campbell-Brown (2012)

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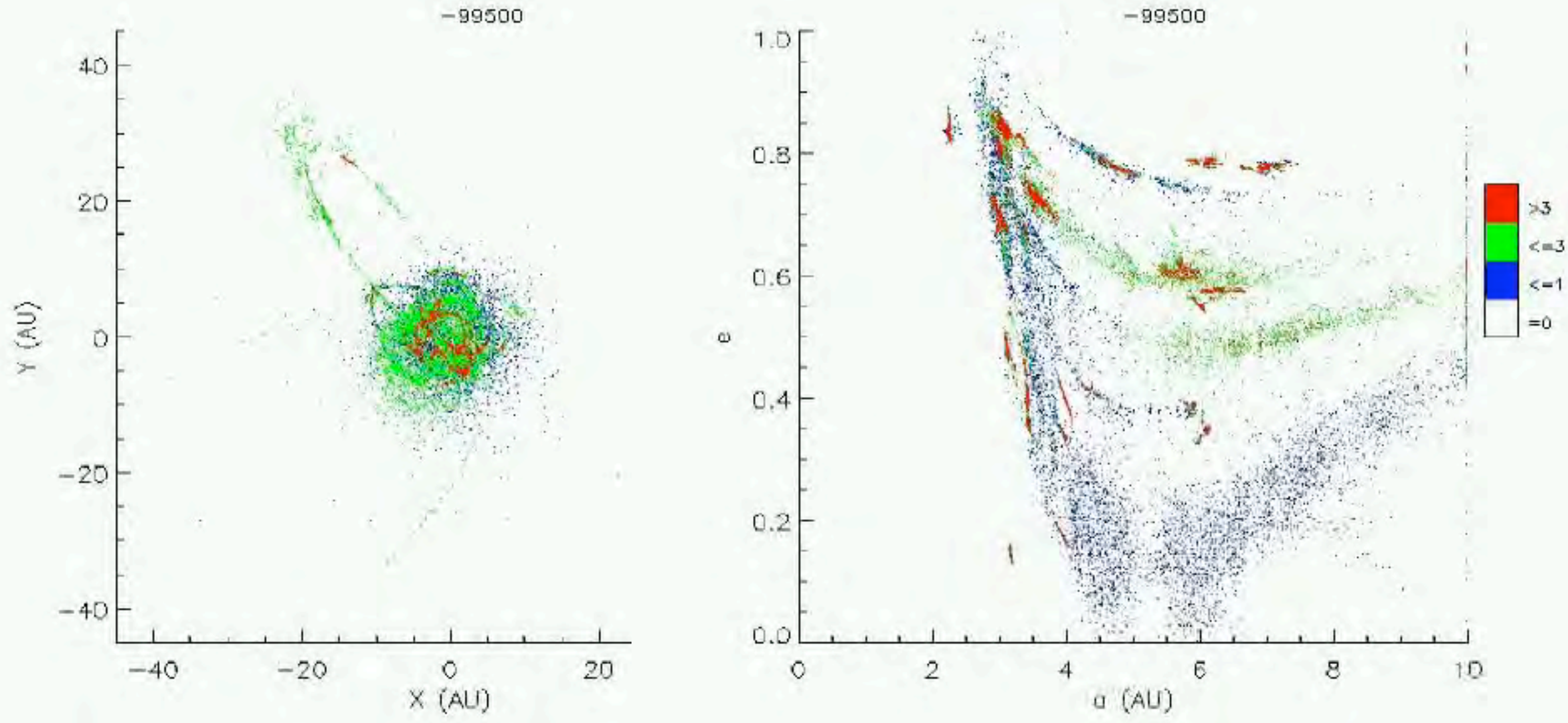


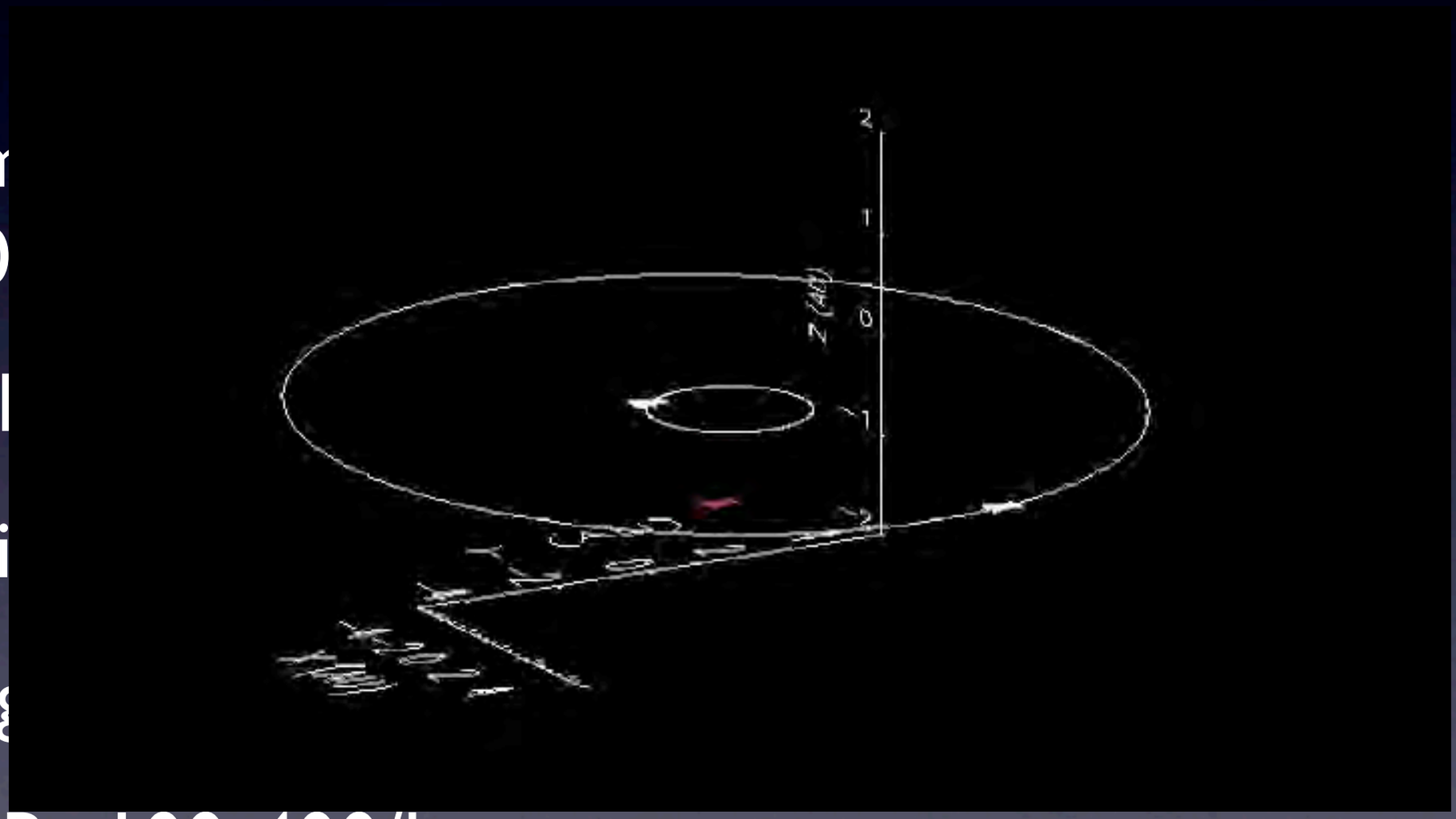
Wiegert, Vaubaillon, Campbell-Brown (2012)

The 2014 Camelopardalids

- comet 209P/LINEAR - 2004 CB
- 24th May 2014
- Trails from XVIIIth-XXth c.
- Large & small particles
- ZHR~100-400/hr

The 2014 Camelopardalids

- com
  200
- 24tl
- Trai
- Larg
- ZHR~100-400/hr



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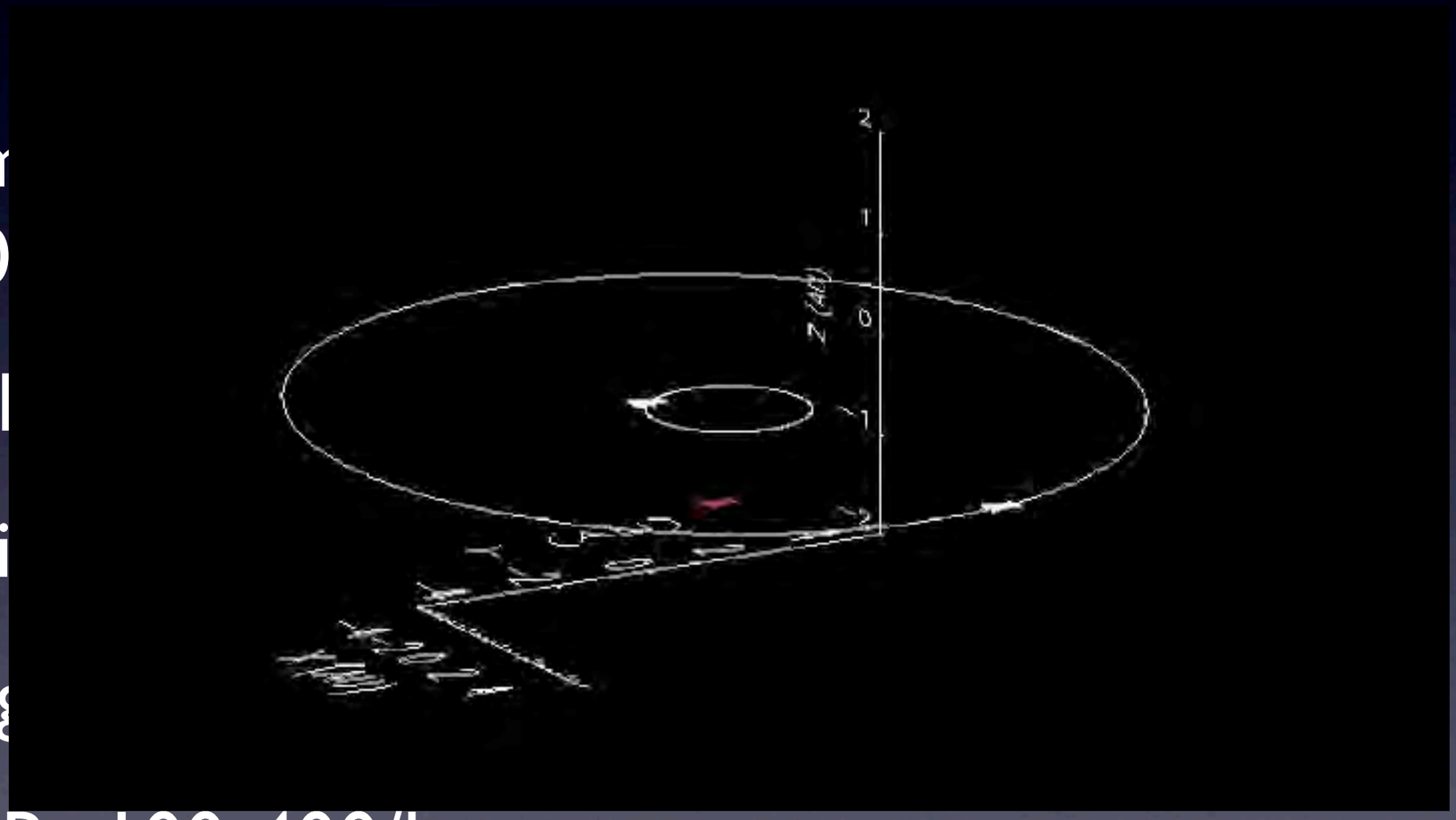

From www.imcce.fr (Vaubaillon)
see also Lyytinen & Jenniskens 2002, and Ye & Wiegert 2013

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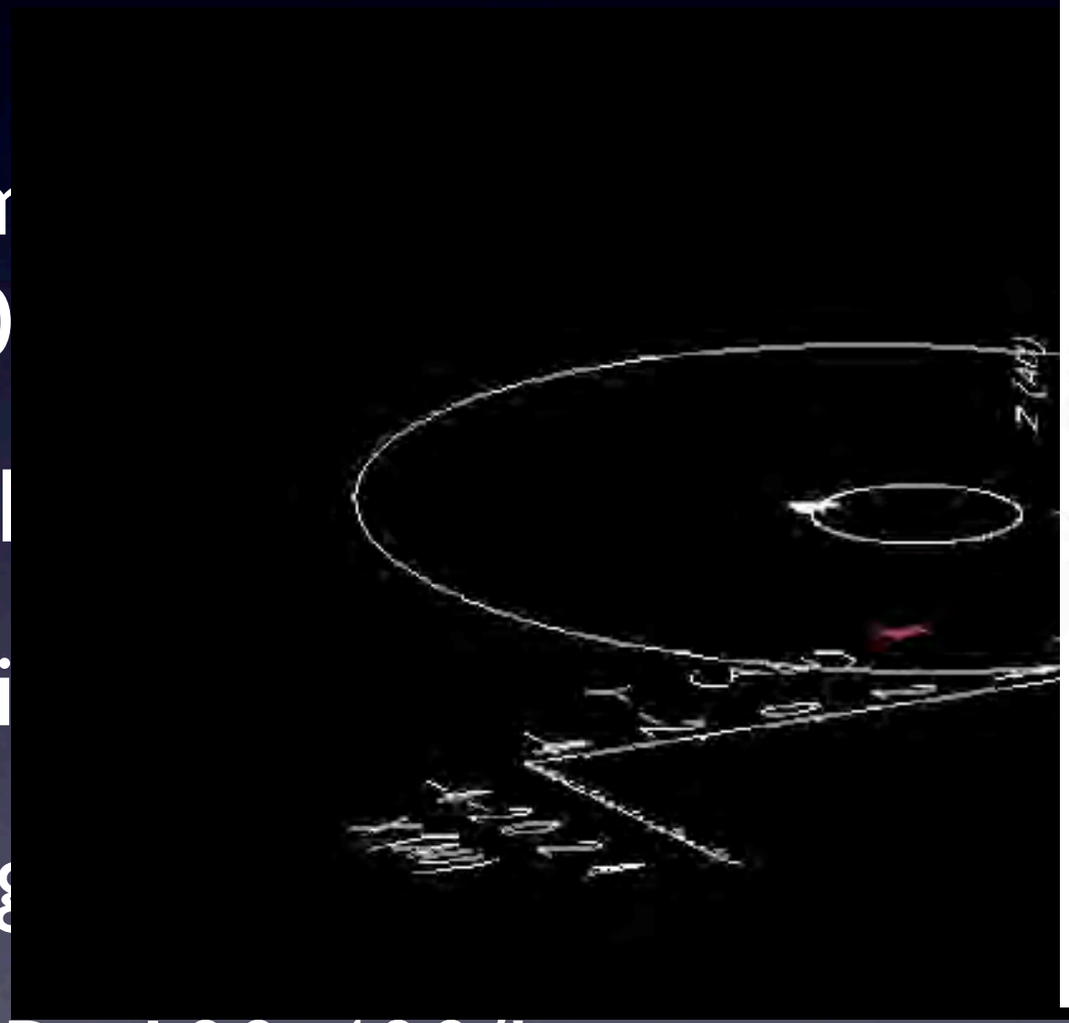

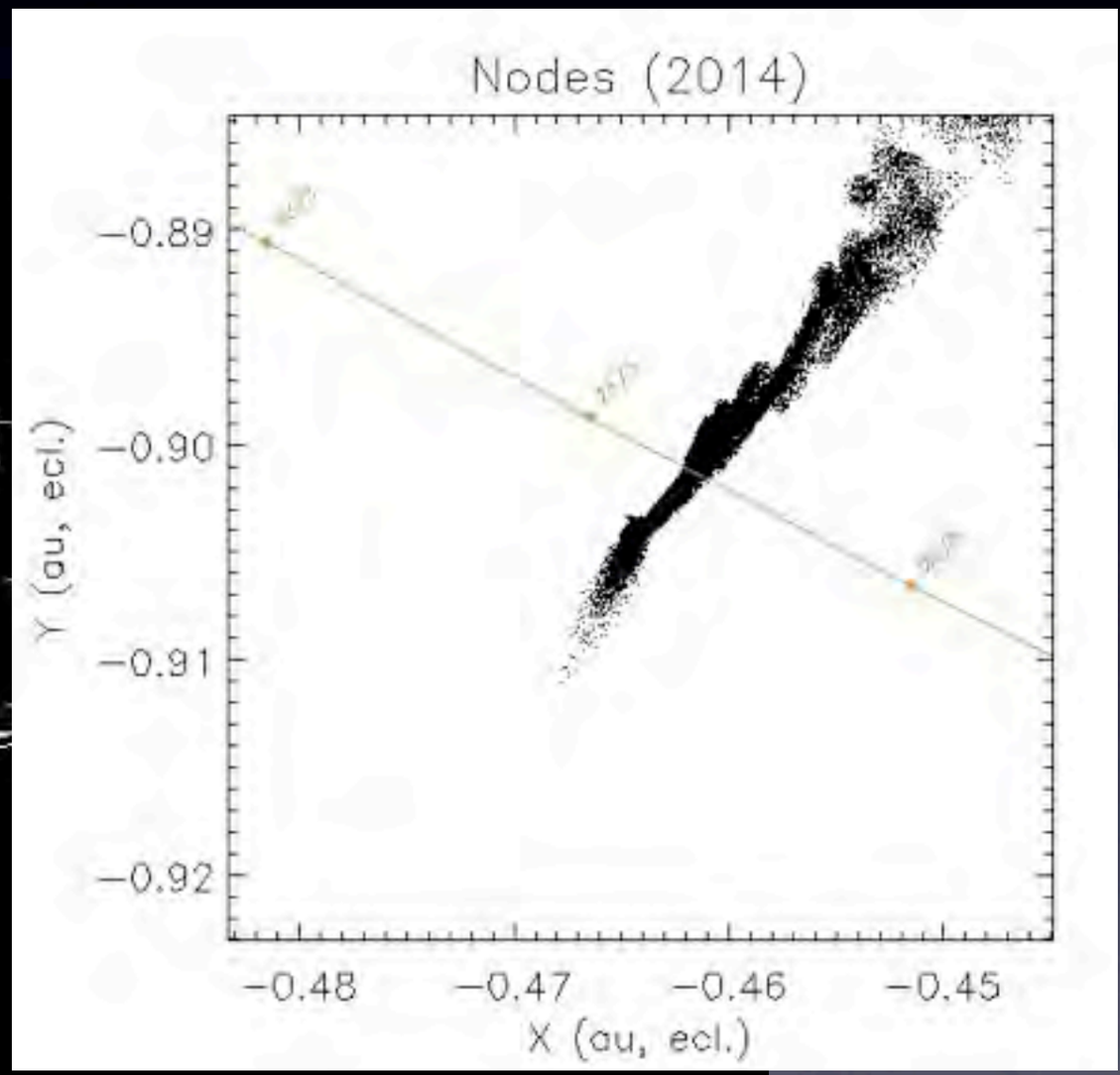

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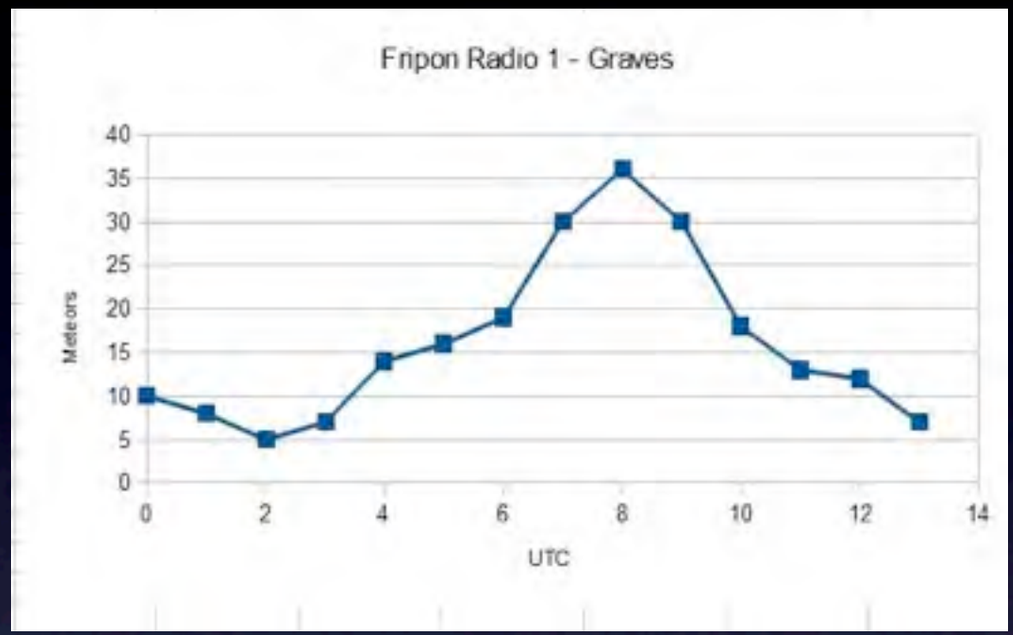
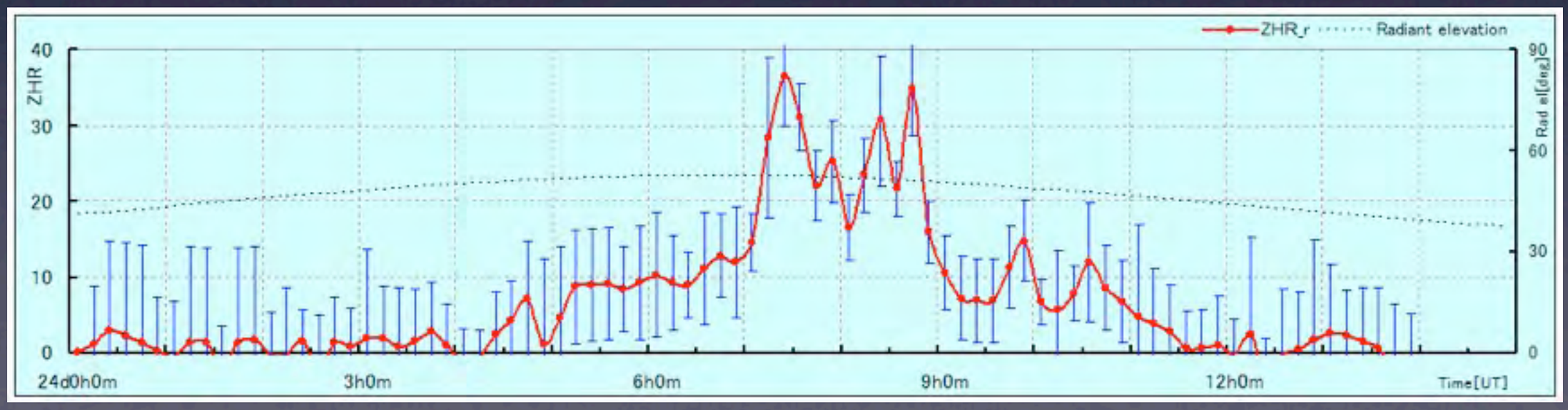
Observations

- visible ZHR ~15/hr
- Radio outburst!



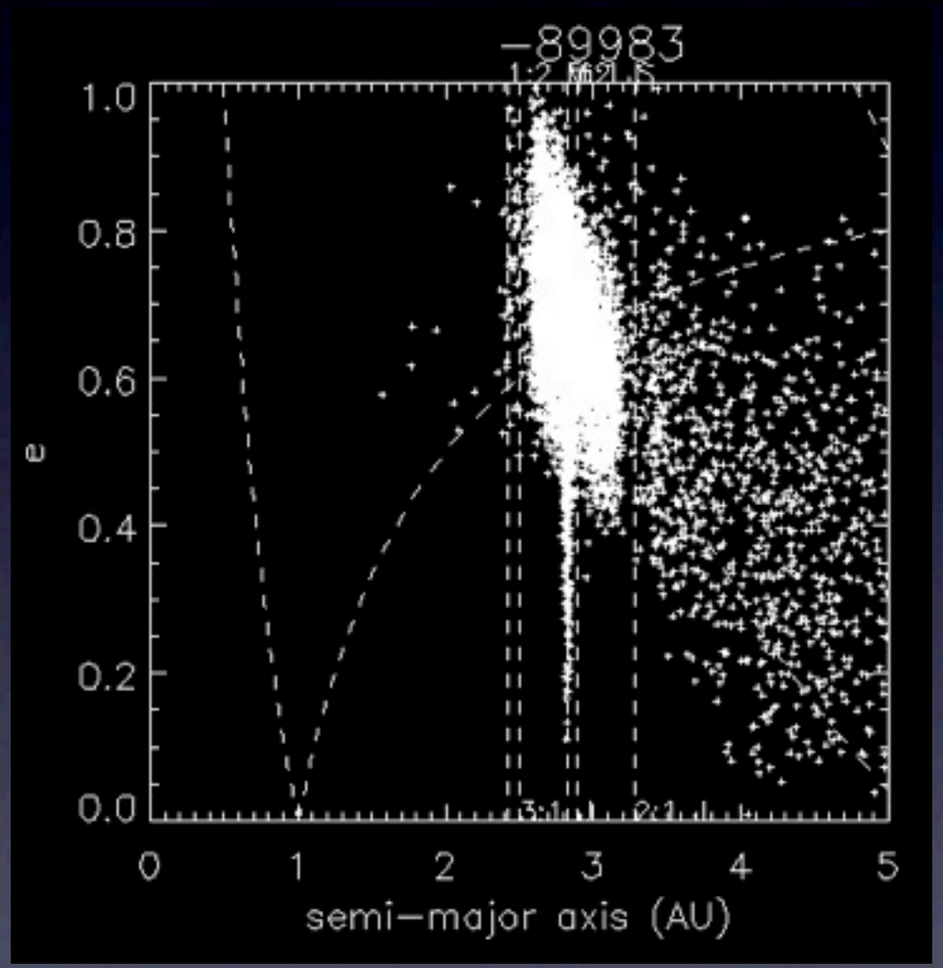
- CMOR - P. Brown

F. Colas - IMCCE



Sugimoto - (personal comm.)

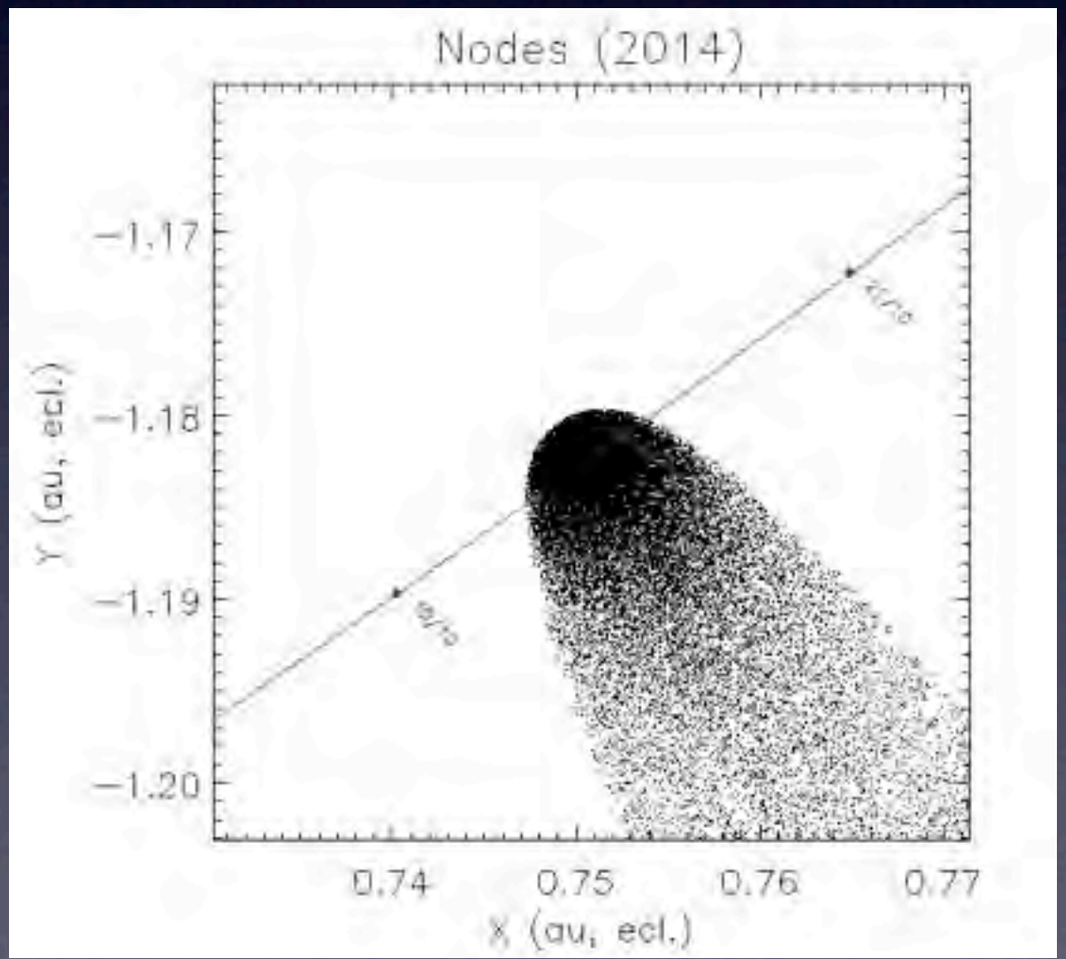
Influence of resonances and dust size distribution



Work in progress in collab. with A. Sekhar and with M. Ishiguro (Seoul Nat. Univ.) & E. Jehin & C. Opitom (ULG)

Comet 2013 A1 Siding Spring at Mars

- min dist: 138000 km
- V=56 km/s
- NEED to know whether or not there is a danger for spacecraft ASAP!!!
- Moorhead et al. 2014, then Vaubaillon et al. 2014



Vaubaillon, Soja, Maquet 2014

But...

- C/2013 A1 discovered by R. McNaught while at 7 au
- nucleus estimate: from 50 to 0.7 km
- [Afrho] can be over-estimated from slow driven dust grains (L. Jorda, pers. comm)
- Farnocchia et al. 2014, Ye & Hui 2014, Tricarico et al. 2014, Tricarico et al. 2014, Kelley et al. 2014 all showed there will be NO encounter whatsoever...

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IS THIS A FAILCON OR WHAT???

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- Basics: need for the parent body ; see also R. Rudawska's work
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- Grain size distribution matters => systematic constrain ; but hard so far
- => NEED (even) closer collaboration with "comet" people

How to perform the forecasting of meteor showers? (2/2)

- How early do we need / want to announce a meteor shower event?
- When are we confident enough to produce a reliable forecast? (timing AND level)
- How to organize a (large) observation campaign?

Acknowledgements

- D. Bérard (IMCCE)
- D. Asher, A. Christou (Armagh Obs)
- H. Sugimoto, P. Brown, Ye (UWO), J.-M. Trigo-Rodriguez (IEEC); J. Toth (Univ. Bratislava), P. Zoladek, M. Wisniewski (PFN), P. Jenniskens (SETI), B. Cooke (MSFC), J. Kero (IRF), S. Calders, H. Lamy (IASB), M. Neijts, A. Pace
- M. Ishiguro (Seoul Nat. Univ.), E. Jehin, C. Opitom (ULG)
- D. Farnocchia (JPL), D. Tricarico (PSI), M. S. Kelley (Univ. Maryland), Q. Ye (UWO), P. Wiegert (UWO)