The Characters of Planet X

not "bad guys"; rather, ...

"misguided"

... fame & fortune awaits

The names are being withheld ...

to protect the guilty.
Mystery Guest # 1

Halley residuals: explained by secular term

(≈ standard non-grav formulae)

Plot: signature back to 295 AD

"If Planet X were the cause instead, this signature would reflect the effect of Planet X."

Labels the plot: "Effect of the Hypothetical Planet [ ! ] on Halley’s Comet"

Table: post-fit residuals from secular term

back to 295 AD

Table: post-fit residuals from Planet X

back to 1456 AD

!!!
Figure 1 — Effect of Pluto and the Hypothetical Planet on

Apparitions of Halley's Comet — dates

(120 - 6) - (120)

Orbital

Difference of perihelion in days

0.4
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1910</td>
<td>241 8781.67872</td>
<td>0.0</td>
<td>0.0</td>
<td>0.00000</td>
<td>0.00000</td>
</tr>
<tr>
<td>1835</td>
<td>239 1598.93817</td>
<td>0.0</td>
<td>0.0</td>
<td>-0.0088</td>
<td>0.00000</td>
</tr>
<tr>
<td>1759</td>
<td>236 3592.55178</td>
<td>+4.2</td>
<td>0.0</td>
<td>+0.0180</td>
<td>+4.17</td>
</tr>
<tr>
<td>1682</td>
<td>233 5655.79508</td>
<td>+8.2</td>
<td>0.0</td>
<td>-0.0358</td>
<td>+8.21</td>
</tr>
<tr>
<td>1607</td>
<td>230 8303.71595</td>
<td>+42.6</td>
<td>-0.1</td>
<td>-0.1312</td>
<td>+42.66</td>
</tr>
<tr>
<td>1531</td>
<td>228 0492.792</td>
<td>+53.5</td>
<td>+0.2</td>
<td>-0.1214</td>
<td>+53.34</td>
</tr>
<tr>
<td>1456</td>
<td>225 3021.202</td>
<td>+49.6</td>
<td>-0.8</td>
<td>-0.0482</td>
<td>+50.35</td>
</tr>
<tr>
<td>1378</td>
<td>222 4684.770</td>
<td>+29.4</td>
<td>-2.1</td>
<td>+0.1315</td>
<td>+31.55</td>
</tr>
<tr>
<td>1301</td>
<td>219 6543.700</td>
<td>-8.7</td>
<td>-3.7</td>
<td>+0.1869</td>
<td>-5.03</td>
</tr>
<tr>
<td>1222</td>
<td>216 7646.0</td>
<td>-51.6</td>
<td>-19.1</td>
<td>+0.0470</td>
<td>-32.48</td>
</tr>
<tr>
<td>1145</td>
<td>213 9378.</td>
<td>-40.5</td>
<td>+1.1</td>
<td>-0.0982</td>
<td>-41.65</td>
</tr>
<tr>
<td>1066</td>
<td>211 0500.</td>
<td>-12.8</td>
<td>+7.5</td>
<td>-0.1791</td>
<td>-20.29</td>
</tr>
<tr>
<td>989</td>
<td>208 2535.</td>
<td>+0.3</td>
<td>-0.5</td>
<td>-0.283</td>
<td>+1.27</td>
</tr>
<tr>
<td>912</td>
<td>205 4366.</td>
<td>+28.7</td>
<td>+2.4</td>
<td>-0.270</td>
<td>+26.33</td>
</tr>
<tr>
<td>837</td>
<td>202 6828.</td>
<td>+37.8</td>
<td>-2.9</td>
<td>-0.164</td>
<td>+40.67</td>
</tr>
<tr>
<td>760</td>
<td>199 8810.</td>
<td>+14.8</td>
<td>+20.2</td>
<td>+0.066</td>
<td>-5.38</td>
</tr>
<tr>
<td>684</td>
<td>197 1199.</td>
<td>-13.1</td>
<td>+30.3</td>
<td>+0.193</td>
<td>-48.34</td>
</tr>
<tr>
<td>607</td>
<td>194 2843.</td>
<td>-60.9</td>
<td>+1.8</td>
<td>+0.081</td>
<td>-62.68</td>
</tr>
<tr>
<td>530</td>
<td>191 4959.</td>
<td>+27.7</td>
<td>+49.1</td>
<td>-0.083</td>
<td>-21.44</td>
</tr>
<tr>
<td>451</td>
<td>188 5969.</td>
<td>+55.2</td>
<td>+7.7</td>
<td>-0.240</td>
<td>+47.54</td>
</tr>
<tr>
<td>374</td>
<td>185 7705.</td>
<td>+95.2</td>
<td>+0.4</td>
<td>-0.263</td>
<td>+94.73</td>
</tr>
<tr>
<td>295</td>
<td>182 8903.</td>
<td>+69.3</td>
<td>-15.5</td>
<td>+84.83</td>
<td></td>
</tr>
</tbody>
</table>

* $e_a = 2.635 \times 10^{-9}$.  

TABLE I

PERIHELION PASSAGES AND RESIDUALS OF HALLEY'S COMET
apparition in order to find where the zero solu-
like those of Figure 4, is being made for the 1986

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>10 planets</td>
<td>10 planets</td>
<td>9 planets</td>
<td>apparition</td>
<td>of</td>
<td>10 planets</td>
<td>of</td>
<td>10 planets</td>
<td>of</td>
<td>10 planets</td>
<td>of</td>
</tr>
<tr>
<td>Orbit 52B</td>
<td>Orbit 12A</td>
<td>47</td>
<td>Year</td>
<td>47</td>
<td>Year</td>
<td>47</td>
<td>Year</td>
<td>47</td>
<td>Year</td>
<td>47</td>
</tr>
</tbody>
</table>

Residuals of Halley's Comet With and Without the trans-Plutonian Planet

TABLE II
Helpfully, he gives both the cartesian and the keplarian elements of his final Planet X orbit.

Only one problem: they are not the same orbit.

\[ M_X = 300 \, M_\oplus \quad = \quad M_J \]

"If a trans-Plutonian planet is to be plausible, its effect on the other planets must be small enough that ...
"

"A program to demonstrate this by ..., a lengthy undertaking, is now in progress."

[ silence ]
More Recent Pronouncements

“The motions of Uranus and Neptune cannot be adequately represented within the present gravitational model of the solar system.”

“All of the Uranus observational data cannot be fit with a single ephemeris.”

“...systematic differences between the observations and ephemerides of Uranus and Neptune...”

“Attempts to change the planetary masses within reasonable constraints did not reduce the residuals.”

The race was on.
Mystery Guest # 2

“The data improvement about 1910... was due..., he thought, to new techniques..., particularly advancements in photographic emulsions.”

After a long derivation and mathematical exposé, he pointed to his result:

“You can all stop searching around, because Planet X is right there.”

\[ m_X = 12.2 \] (!)

“It is hard to see how Tombaugh could have missed it. ...

“Either Tombaugh was mistaken in thinking that he could not have missed a planet brighter than 16th magnitude,

or

my calculations are mistaken.”

More likely, he feels, his gravitational model of the outer solar system is wrong, perhaps because there is an eleventh planet out there whose gravitational effects are confusing matters.
Mystery Guest # 3

"... if the discrepancies have any cause other than a planet X, all the results here obtained would make little sense."

In response to a referee questioning the level of significance:

"...if the last ten years of observations were suppressed from the least squares analysis, a quite different set of corrections would be determined."
Mystery Guest # 4

Ref: “Your method doesn’t work since $\epsilon$ isn’t small.”
[paper rejected]

Nevertheless, soon in another journal, we find

“... with $\epsilon = a_N/a_X$, I find ...”

[ $\epsilon \approx 0.7$ ]

***********

“... errors in the masses of some of the known planets may be a possible source of the observed systematic residuals.”

[ He then chose a non-Voyager mass for Neptune ]

“... systematic behavior in the longitude residuals ... is much smaller than before. ... residual trends can be produced by uncertainties in the ... masses ...”

[ but he didn’t solve for the masses ...]
“Would a collision on Uranus explain its systematic residuals?”

“We demonstrate, however, that he underestimated the energetics of such an encounter by twelve [! ] orders of magnitude...”

“... a possible explanation of the systematic residuals shown in Fig. 1”

“The residuals in longitude, after the inclusion of the impact, are shown in Fig.3. The fit is good, ...”
Fig. 3. Residuals in longitude after the inclusion of the collision.
Fig. 3. Residuals in longitude after the inclusion of the collision
“Xxxxx* is paid to be a skeptic... Just like Myles has an obligation to go to his boss and say, ‘We’ve got the solar system under control. Here it is. Now you can fly your mission.’ For me to come along and say, ‘Aha, you’ve overlooked the 10th planet’ – that makes them look bad.”

“I sure don’t feel this is worth putting a lot of time on, but NASA at least gave me $15K this year to look.

[ coverage diagram ]

“The Location of Planet X” ( ! )
Primary author in a paper describing the 1911 improvement from the impersonal traveling micrometer

"But about that time [ca. 1910] a strange thing happened:

Neptune and Uranus started behaving themselves."

"He said that he has studied the older data extensively, ..."

[he never had the data in his possession]

"Well, yeah; I'm trying to get more funding ..."
Sobering comments

“We are being less than honest when we pretend to be able to predict the location of any mass on the basis of this optical data.

Further, we are misleading competent observers and wasting valuable telescope time.”

“If you must make a prediction, be smart; predict the planet to be where Tombaugh didn’t search.”
1991

Intention : Show that the optical data problems are big enough to account for the Uranus residuals

First : Be certain that Uranus’ orbit is well-fit to the data

NO

First : Adjust for the correct Neptune mass
I.e., Voyager!

Then : Re-fit Uranus’ orbit

Voila!
"Xxxxx* is paid to be a skeptic...

* Cosmic Cop
Brian Marsden: Cosmic Cop

By David H. Levy

"MASTER of the Universe!" That was how a newspaper headline once described Brian Marsden, the man who decides who gets credit for discovering anything astronomical that moves or explodes in the sky. This month I salute Marsden as he celebrates 25 years as director of the International Astronomical Union's Central Bureau for Astronomical Telegrams.

Marsden polices the sky from his office at the Smithsonian Astrophysical Observatory in Cambridge, Massachusetts, with a laugh. "That was a Saturday."

During his long career, Marsden has had his share of adventures. In 1957, while a summer student at the Royal Greenwich Observatory, then located at Herstmonceux Castle in southern England, some of his colleagues hatched a plan to handcuff and kidnap him. "I like to think they were concerned I was working too hard," Marsden recalls. Fortunately, two female colleagues warned him of the impending prank, and Marsden avoided his office on the