

Ninth planet in the solar system (not Pluto)

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A horizontal line of planets from the solar system is shown against a starry background. From left to right, the planets are Mercury (small, grey), Venus (orange), Earth (blue and green), Mars (red), Jupiter (large, orange and white stripes), Saturn (large, yellowish with prominent rings), Uranus (medium, light blue), and Neptune (medium, dark blue). A bright sun is visible on the far left, creating a lens flare effect.

Ninth planet in the solar system



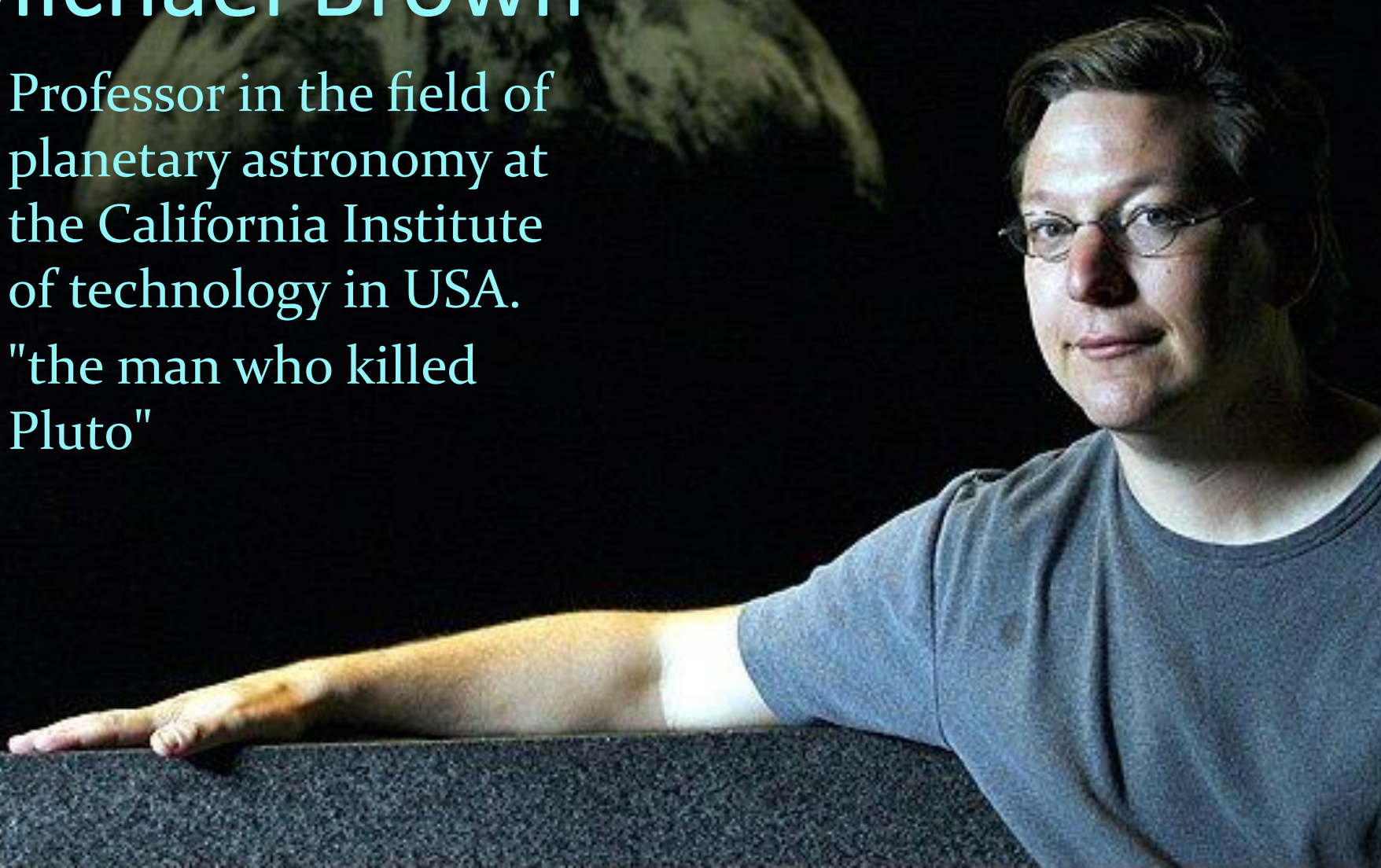
Planet X



Earth

Michael Brown

- Professor in the field of planetary astronomy at the California Institute of technology in USA.
- "the man who killed Pluto"



Konstantin Batygin

$$\mathcal{H}_{\text{top}} = -\frac{1}{4} \frac{GM}{a} \left[\frac{1}{\sqrt{1-e}} \right]^3 \sum_i \frac{m_i a_i}{M a^2} \rightarrow \frac{P_{\text{top}}}{P_{\text{orb}}} = \frac{1}{3}$$

$$= \frac{1}{4} \frac{GM}{a} \sqrt{\frac{GM}{a}} \sqrt{1-e^2} (1-\cos(i)) \frac{m_i a_i}{M a^2} \frac{1+3e^2}{(1-e)^2}$$

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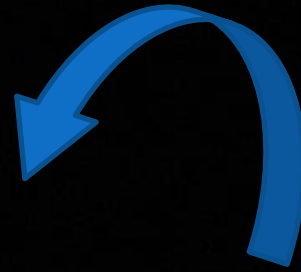
$$\frac{d}{dt} \left(\frac{r^2}{2} \dot{\theta} \right) = \frac{GMm}{r^2} \cos(i) \frac{dr}{dt} + \dots$$

$$\frac{GMm}{a^2} \frac{e \sin(\theta)}{1+e \cos(\theta)} \frac{dr}{dt} + \dots$$

Research field: planetary astronomy

- In 2014 astronomers discovered a true twin of the Earth in the red Dwarf system.

Water on Mars



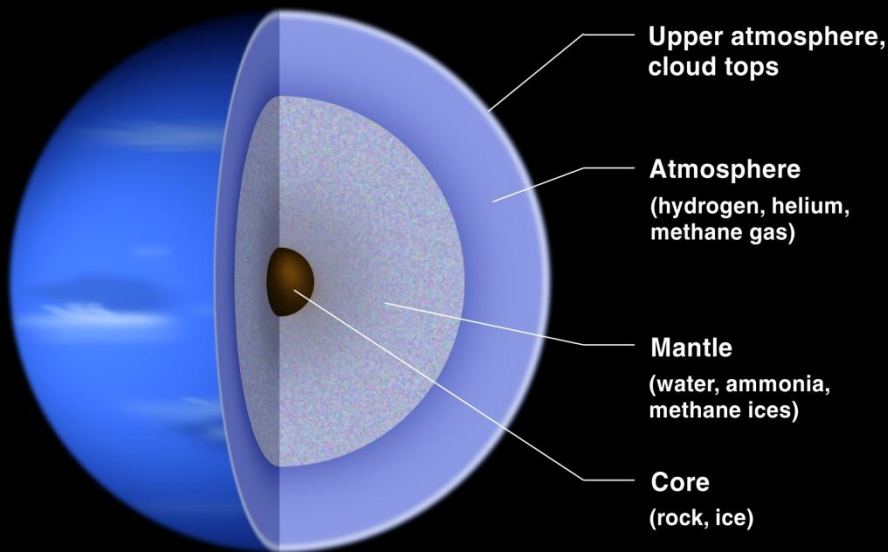
- The theory about availability of water on Mars was confirmed!

The discovery of the planet

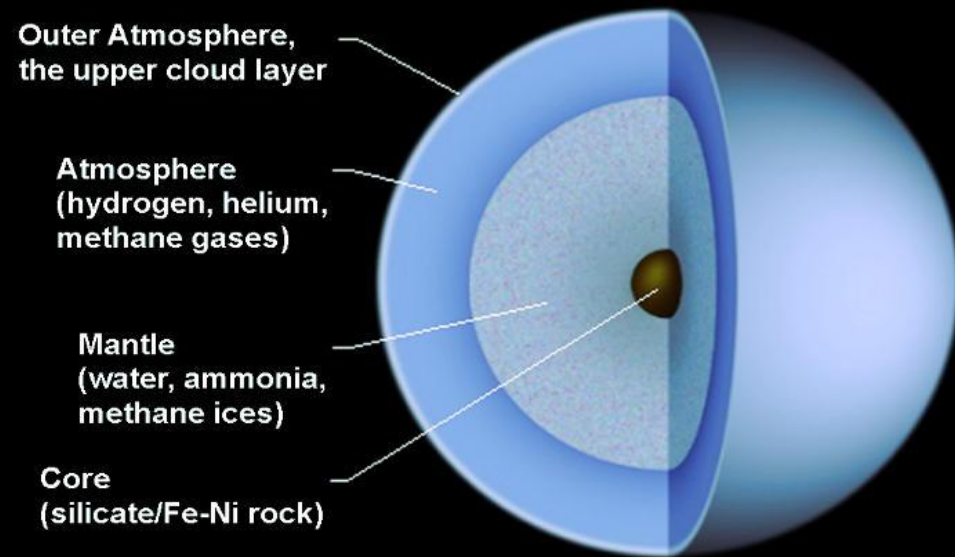
- Chadwick Trujillo and Scott Sheppard published in Nature article which suggested that in a distance of 250 astronomical units from the sun there is a planet larger than Earth.



The structure of the planet X



NEPTUNE



Internal Structure of Uranus