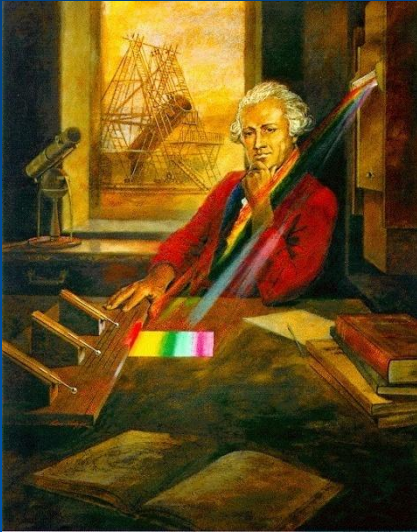




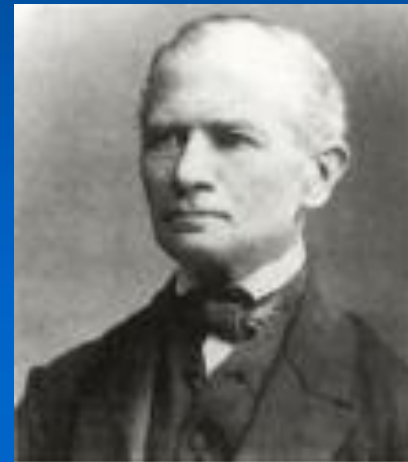
# Epitafium dla Plutona

Dr Tomasz Mrozek  
Instytut Astronomiczny  
Uniwersytet Wrocławski

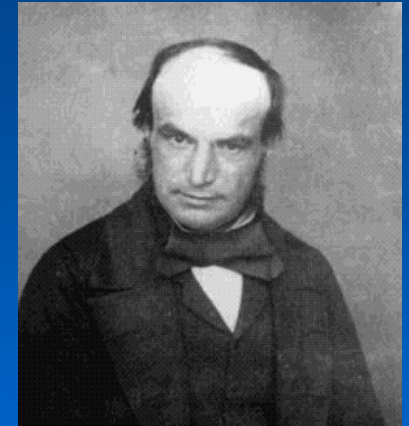
# Od początku... Uran i Neptun



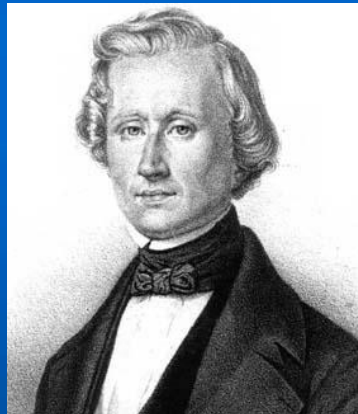
**Sir William Herschel**



**Johann Gottfried Galle**



**John Couch Adams**



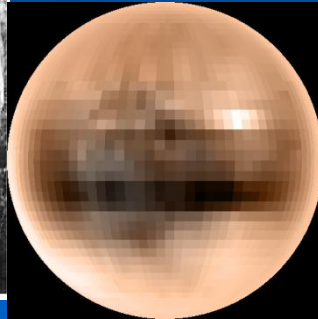
**Urbain Jean Le Verrier**



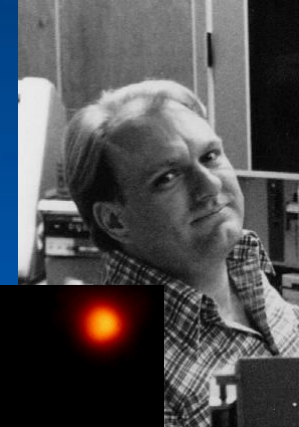
# Pluton i jego księżyce



Clyde Tombaugh



James Christy



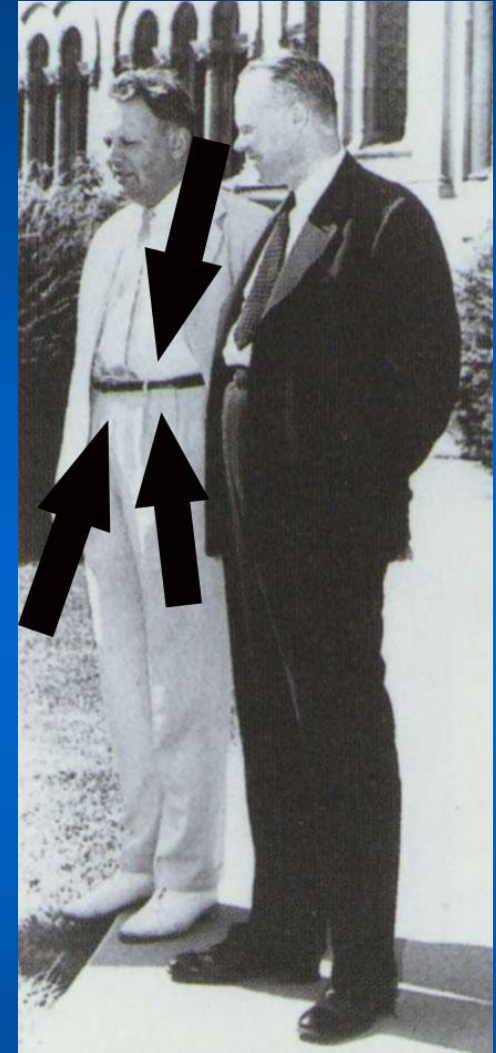
Weaver, H. A.; Stern, S. A.; Mutchler, M. J.;  
Steffl, A. J.; Buie, M. W.; Merline, W. J.;  
Spencer, J. R.; Young, E. F.; Young, L. A.

# Pas Kuipera



**Kuiper (1951): Pluton jest tak masywny, że w jego otoczeniu nie ma innych obiektów.**

**Edgeworth(1943) i Leonard (1930):  
W okolicach Plutona znajduje się duża liczba drobnych ciał stanowiących rezerwuar komet krótkookresowych.**





# Obiekty transneptunowe - przesłanki

- 1. Komety  
krótkookresowe**
- 2. Modele powstawania  
układów planetarnych**
- 3. Obserwacje dysków  
protoplanetarnych**

# Dyski protoplanetarne i pyłowe



10 000 lat



100 000 lat

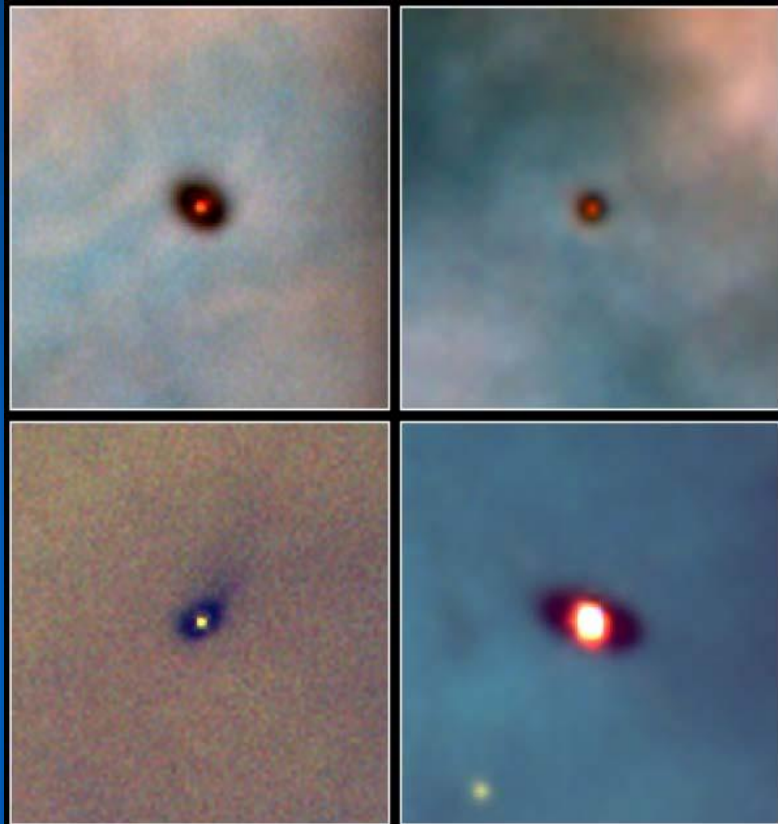


100 000 000 lat





# Dyski protoplanetarne i pyłowe

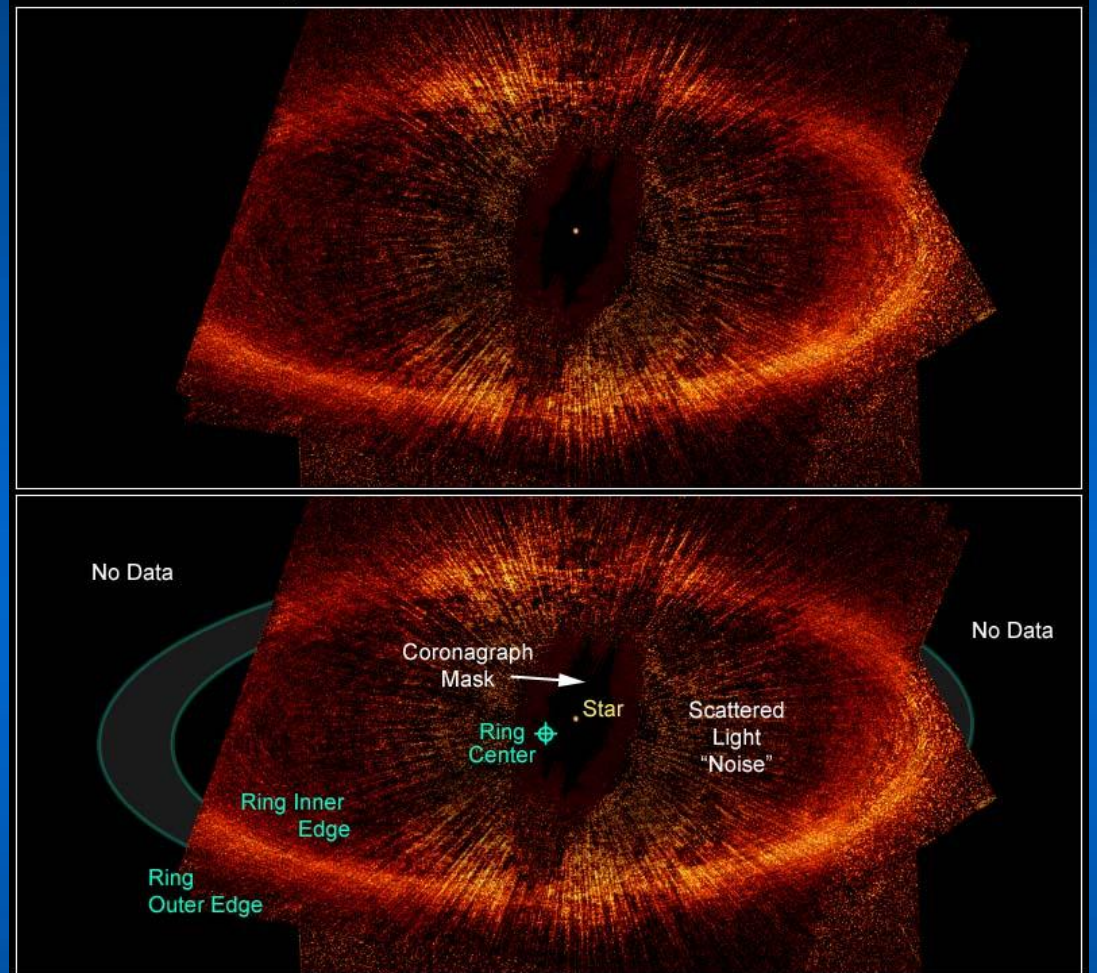


**Protoplanetary Disks  
Orion Nebula**

HST · WFPC2

PRC95-45b · ST ScI OPO · November 20, 1995  
M. J. McCaughrean (MPIA), C. R. O'Dell (Rice University), NASA

**Fomalhaut Debris Ring** Hubble Space Telescope · ACS HRC



NASA, ESA, P. Kalas and J. Graham (University of California, Berkeley)  
and M. Clavin (NASA/GSFC)

STScI-PRC05-10



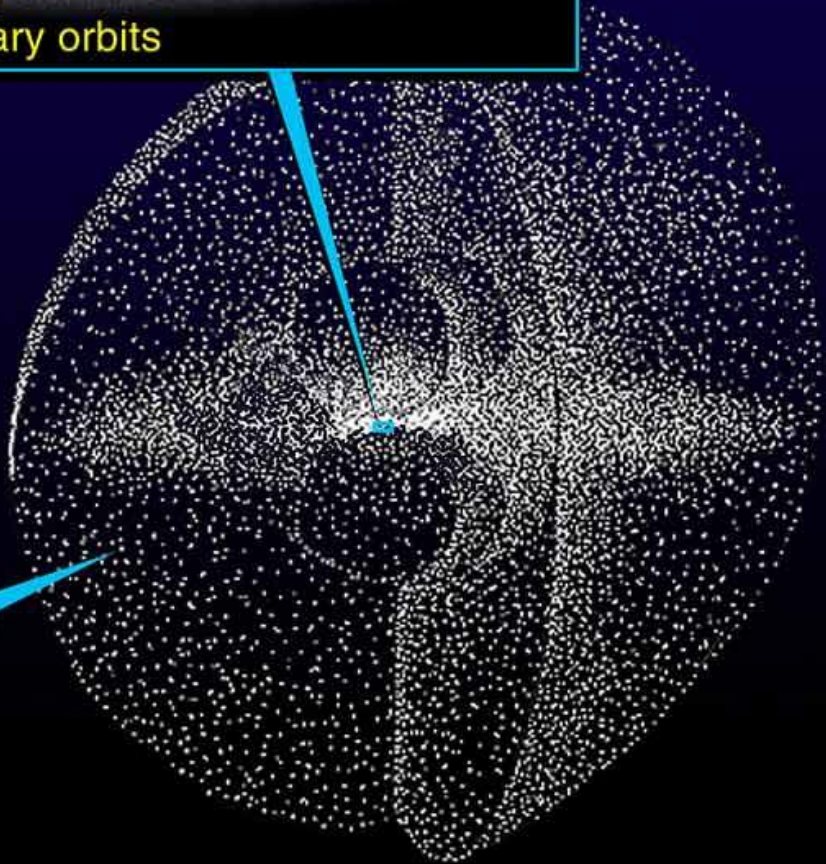


# Obiekty transneptunowe i obłok Oorta



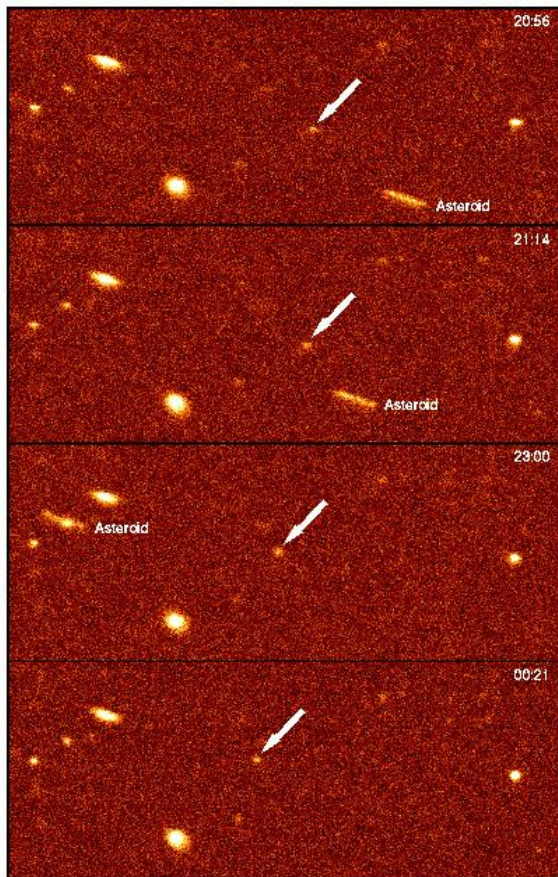
The Oort Cloud  
(comprising many billions of comets)

This text is enclosed in a blue-bordered box and is connected to the Oort Cloud illustration by a blue line.



Oort Cloud cutaway drawing adapted from Donald K. Yeoman's illustration (NASA, JPL)

# Początek serii



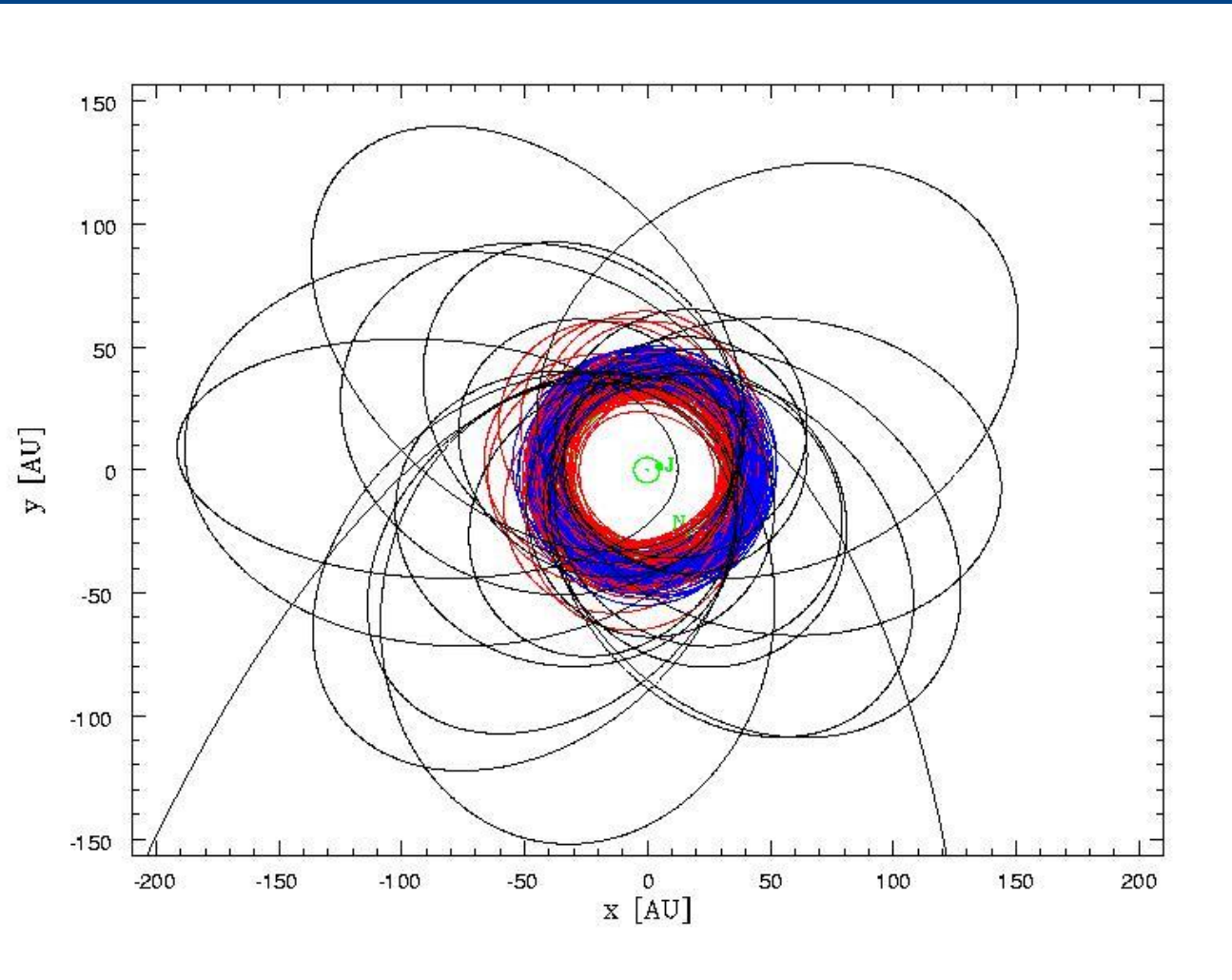
**D. Jewitt i J. Luu**

**IAU Circular No. 5611  
14 wrzesień 1992**

**1992 QB1**



**Obecnie: ponad 1000 obiektów**





# Obiekty transneptunowe-klasyfikacja

**Plutonki – obiekty pozostające w rezonansie  
3:2 z Neptunem (134340 Pluton,  
136199 Eris)**

**Twotino – obiekty pozostające w rezonansie  
2:1 z Neptunem**

**Cubewano – obiekty nie pozostające  
w rezonansie**

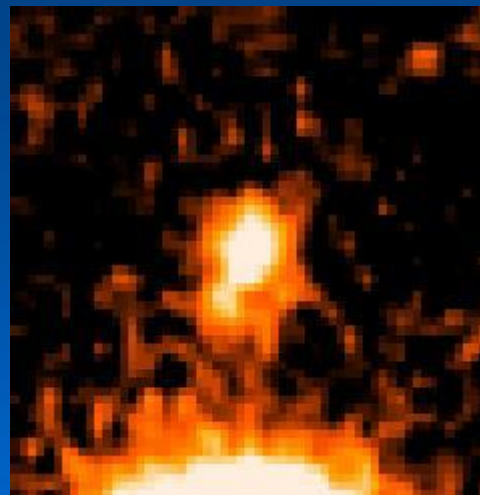
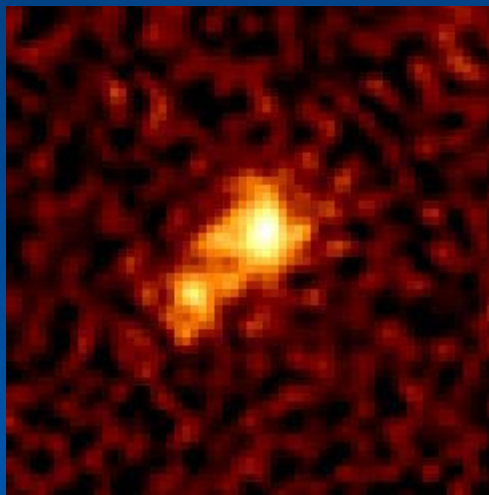
**Rozproszone – mocno wydłużone orbity,  
duże nachylenia do  
płaszczyzny ekliptyki**

# Obiekty podwójne



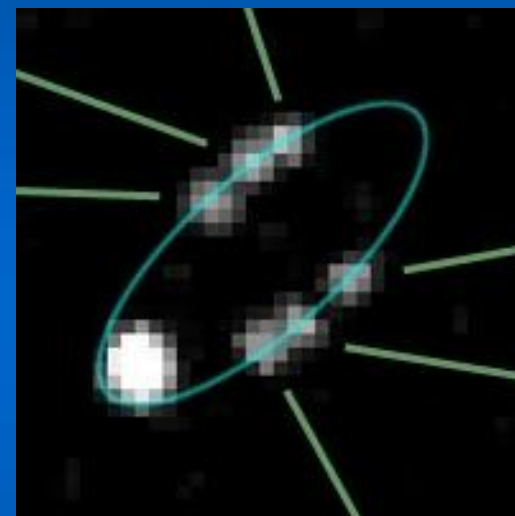
Object	a [km]	e	i [deg]	Type	Q [arcsec]	P [days]	DMag
Pluto	19,600	0.00	96	PKBO	0.9	6.4	3.2
1998 WW31	22,300	0.8	42	CKBO	1.2	574	0.4
2001 QT297	----	---	---	CKBO	0.6	---	0.5
2001 QW322	---	---	---	CKBO	4.0	---	0.4
1999 TC36	---	---	---	PKBO	0.4	---	1.9
1998 SM165	---	---	---	SKBO	0.2	---	1.9
1997 CQ29	---	---	---	CKBO	0.2	---	0.3
2000 CF105	---	---	---	CKBO	0.8	---	0.9
2001 QC298	---	---	---	CKBO	0.17	---	N/A
2003 EL61	49,500+/-400	0.050+/-0.003	234.8+/-0.3	SKBO	1.5	49.12+/-0.03	3.3

# Obiekty podwójne



Pluto and Charon

Obtained from: <http://antwrp.gsfc.nasa.gov/apod/ap990213.html>



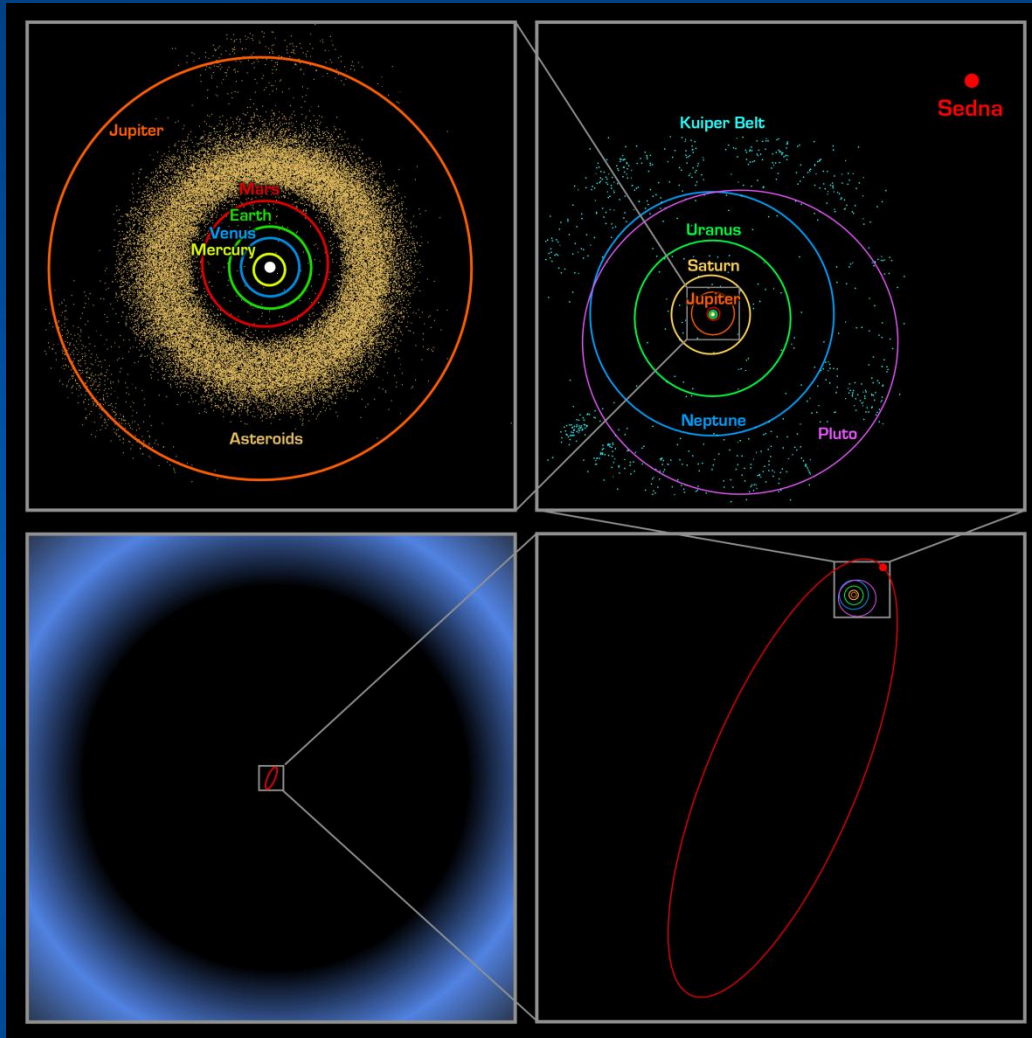


# Duże TNO





# A obłok Oorta ?



## Sedna (2003 VB12)

Rozmiar:

1000 – 1500 km

Peryhelium:

76 AU

Aphelium:

990 AU

Jeszcze nie to...



# Epitafium dla Plutona

Pluton nie został zdegradowany, po prostu nigdy nie był planetą

Należy do grupy obiektów w naturalny sposób powstających wokół planet

Argumenty za planetą Plutonem:

- sentyment
- pieniądze
- sztuczny podział zamiast wiedzy na temat powstawania układów planetarnych

Był taki czas, że w Układzie Słonecznym mieliśmy aż 18 planet !

## THE PLANET HYGEEA.

M. GASPARIS, of Naples, who discovered this planet on April 12, 1849, has furnished the following elements of its orbit, derived from several observations : —

Epoch, May 1, 1849.	
Mean anomaly, . . . . .	326 34 22".44
Longitude of perihelion, . . . . .	242 47 3.44
“ node, . . . . .	285 32 29.72
Inclination, . . . . .	3 46 51.27
Mean daily motion, . . . . .	590".3784

This newly discovered planet belongs to the same group with *Astræa*, *Hebe*, *Iris*, *Flora*, and *Metis*, all of which are, as will be seen below, of very recent discovery. The planets known from high antiquity are *Mercury*, *Venus*, *Earth*, *Mars*, *Jupiter*, and *Saturn*. To these, in 1781, was added *Uranus*, or *Herschel*, as it is sometimes called, from the name of its discoverer. Early in the present century, astronomers became convinced that a planet existed between Mars and Jupiter, and an association of twenty-four observers was formed to examine the whole heavens. But, early in January, 1801, the present planet *Ceres* was accidentally discovered by Piazzi, in Sicily. In March, 1802, *Pallas* was discovered by Olbers, in Bremen, and this was followed, in 1804, by the discovery of *Juno*, and, in 1807, by that of *Vesta*. On December 8, 1845, *Astræa* was discovered by Professor Hencke, and on July 1, 1847, he also discovered *Hebe*. *Iris* was discovered August 13, 1847, and *Flora*, October 18 of the same year, both by Mr. Hind. *Metis* was, we believe, discovered by Mr. Graham, in Ireland, on April 25, 1848. The recent extraordinary discovery of *Neptune* is familiar to all. The total number of primary planets discovered, up to the present time, is, it will be seen, 18. Many of them are never visible to the naked eye. — *Editors*.



**KONIEC**