彗星傳奇

陳文屏

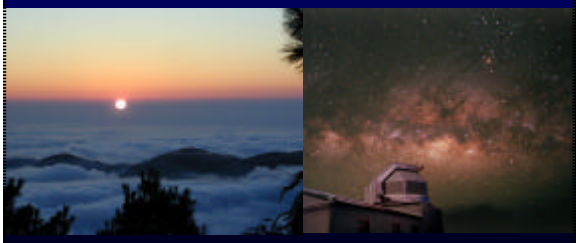
中央大學天文所、物理系

2004.05.29 NCU

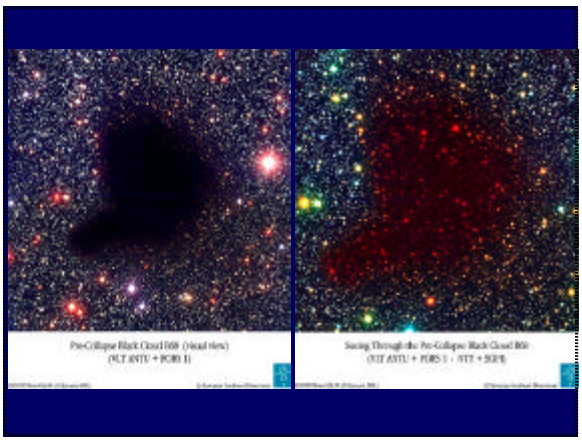
Thomas Nast, cartoon - "The Comet of Chinese Labor" (1870)

長沙馬王堆出土西漢帛畫中的彗星圖

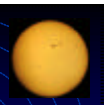
放眼望去，一半是天！



天地輪遞，一半是夜！



太陽系中的各式天體

雲氣收縮、中央溫度升高、點燃核反應 → 太陽

雲氣縮成扁盤狀、盤中灰塵凝集 → 小行星

✓ 繼續凝集 → 行星

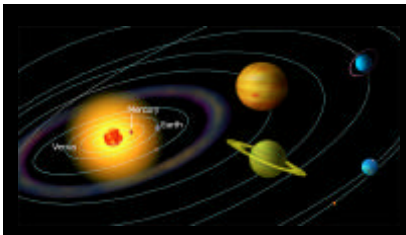
※旁邊扁盤中的灰塵凝集→ 衛星

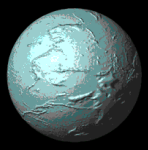
※不成形的 → 外行星的環

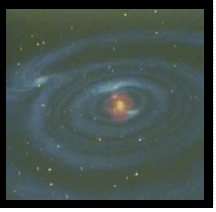
✓ 不成形 → 留在原地，例如小行星帶

→ 被拋到遠方 → 歐特雲中的彗星核

不小心進入太陽系內圍 → 彗星







那，剩下的東西呢？

太空中充滿了大大小小的碎渣到處遊走

太空處處「槍林彈雨」

月球表面有大量撞擊的痕跡

Gaspa 小行星的表面也有很多撞擊的證據

木星也曾被撞得鼻青臉腫

槍林彈雨的太空

- 剩下的大小碎渣在太空中遊走，四處亂撞，地球也不倖免
- 萬一撞到了．．．

  如沙粒般的碎渣掉入大氣 → 流星

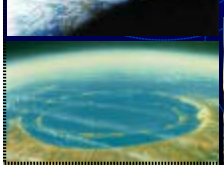
  地球撞向彗星留在軌道上的殘渣 → 流星雨

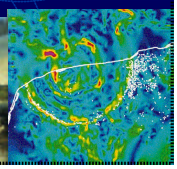
  大一點的如小石，燃燒剩餘部分落到地面 → 隕石
- 再大一點的呢？

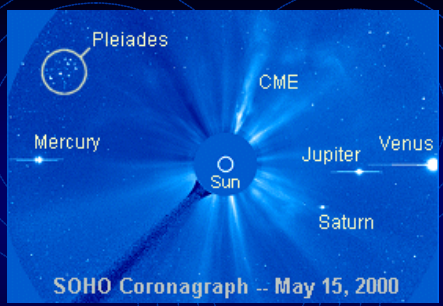
恐龍怎麼滅種的？

6500萬年前的撞擊！

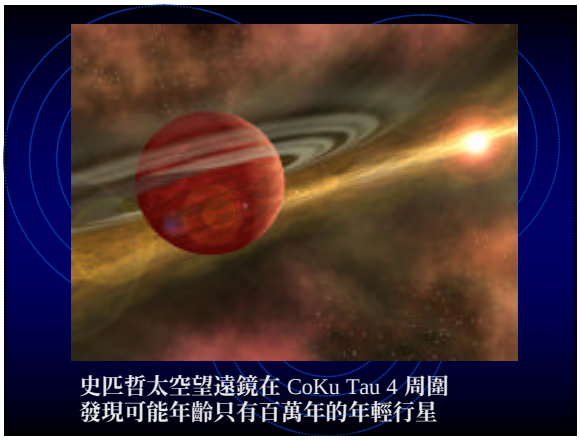
Yucatan 半島Chicxulub 村



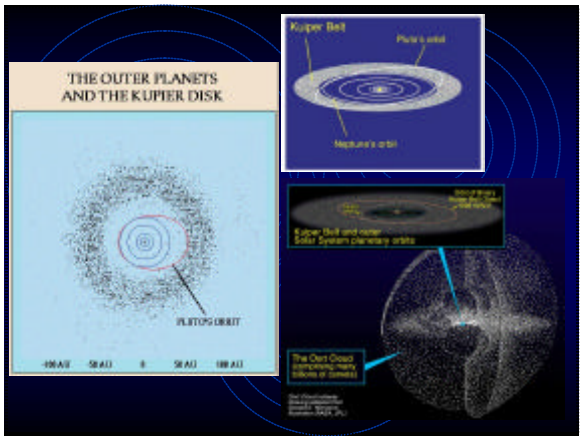


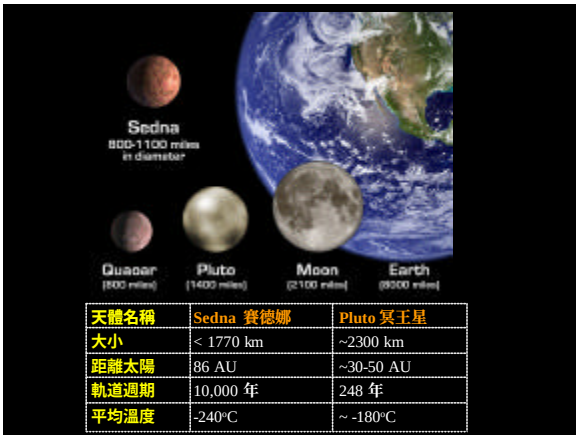


彗星撞太陽



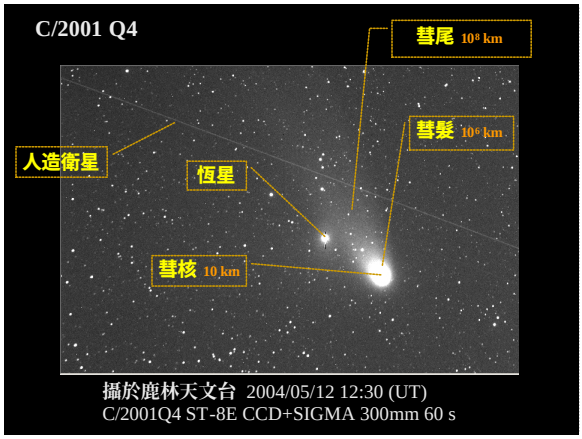
史匹哲太空望遠鏡在 CoKu Tau 4 周圍
發現可能年齡只有百萬年的年輕行星





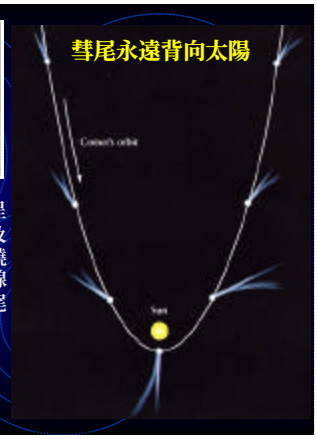
天體名稱	Sedna 賽德娜	Pluto 冥王星
大小	< 1770 km	~2300 km
距離太陽	86 AU	~30-50 AU
軌道週期	10,000 年	248 年
平均溫度	-240°C	~ -180°C

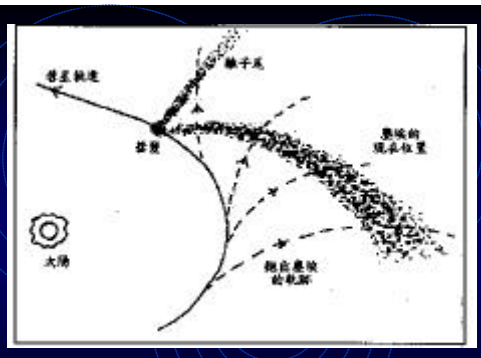
天上星星數不盡、只有暗夜看得清



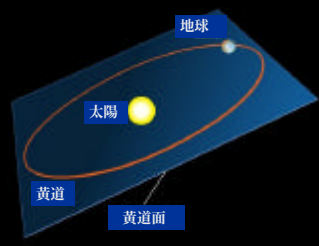
攝於鹿林天文台 2004/05/12 12:30 (UT)
C/2001Q4 ST-8E CCD+SIGMA 300mm 60 s

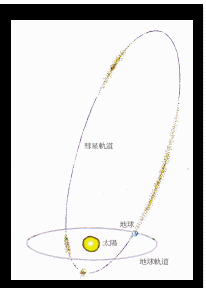
（上）太陽磁場因自轉大致呈螺旋狀分佈；（下）太陽風及磁場與彗星交互作用，磁場繞著彗星彎曲，離子順著磁力線運動在「下風」處形成離子尾





被拋出的塵埃與彗星一樣，受到太陽引力牽引而繞太陽公轉





行星繞行太陽的軌道幾乎呈圓形，且幾乎位於同平面上（黃道面），但有些彗星的軌道卻狹長而歪斜

流星與彗星塵

- Comet Biela —— 上世紀最有名的彗星之一，發現於 1826年，週期 6.8 年
- 1846 分裂為二；1852 年兩顆碎塊都出現了，相隔2百萬公里
- 從此就不見了 …
- 但1872年當地球通過該彗星軌道

➔ 流星雨！

Near –Earth Asteroid Tracking (NEAT)

- 兩座1.2公尺口徑望遠鏡搜尋「近地小行星」

Lincoln Near Earth Asteroid Research (LINEAR)

Space Guard in Japan

Space Watch (USA, Arizona)

THE INNER SOLAR SYSTEM

This animation shows the motion of the inner part of the solar system over a two-year time period. The sun is at the center and the orbits of the planets Mercury, Venus, Earth and Mars are shown in light blue (the locations of each planet are shown as large crossed circles). Comets are shown as blue squares (numbered periodic comets are filled squares, other comets are outline squares). Main-belt minor planets are displayed as green circles, near-Earth minor planets are shown as red circles.

The individual frames were generated on an OpenVMS system, using the PGPLOT graphics library. The animation was put together on a RISC OS 4.03 system using !InterGif.

+ 近地小行星　o 主帶小行星　□ 彗星

THE MIDDLE SOLAR SYSTEM

This animation shows the motion of the middle part of the solar system over a two-year time period. The sun is at the center and the orbits of the planets Mercury, Venus, Earth Mars and Jupiter are shown in light blue (the locations of each planet are shown as large crossed circles). Comets are shown as blue squares (numbered periodic comets are filled squares, other comets are outline squares). Main-belt minor planets are displayed as green circles, near-Earth minor planets are shown as red circles.

The individual frames were generated on an OpenVMS system, using the PGPLOT graphics library. The animation was put together on a RISC OS 4.03 system using !InterGif.

THE OUTER SOLAR SYSTEM

This animation shows the motion of the outer part of the solar system over a 100-year time period. The sun is at the center and the orbits of the planets Jupiter, Saturn Uranus and Neptune are shown in light blue (the locations of each planet are shown as large crossed circles).

Comets: blue squares (filled for numbered periodic comets, outline for other comets)
High-e objects: cyan triangles
Centaurs: orange triangles
Plutinos: white circles (Pluto itself is the large white crossed circle)
'Classical' TNOs: red circles
Scattered Disk Objects: magenta circles

The individual frames were generated on an OpenVMS system, using the PGPLOT graphics library. The animation was put together on a RISC OS 4.03 system using !InterGif.

彗星的命名

C/2002 C1

C=彗星 A=小行星
P=週期彗星
回歸超過一次排序

一旦確定為新發現，即刻以年月命名
A=Jan 1/2
B=Jan 2/2

Comet Ikeya-Zhang

發現者：人（例如百武）、研究計畫（例如 NEAT）

例如：1P/Halley; 2P/Encke; Comet Hale-Bopp=C/1995 O1

C/2001 Q4 (NEAT)

By HC Lin 林宏欽 at Lulin Observatory, 2004-05-07

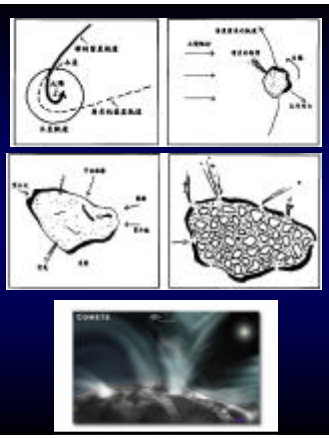
C/2001 Q4

By HC Lin 林宏欽

2004-05-10
ST-8E CCD+SIGMA
300mm F2.8->F4

R-band 60sec

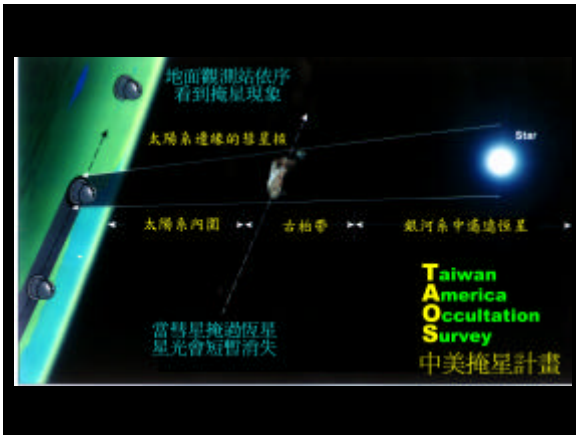
6幅合成+MaxIm-DL
Digital Development
processing



By ZY Lin 林忠義 with LOT+PI 1300B R-band 10 s, 2004-05-04

結論

- 太陽系源於星際雲氣與塵埃
- 旋轉又收縮的盤狀雲氣中央形成太陽
- 盤狀雲氣中的彗星（冰體）與小行星（岩石體）等小天體，彼此凝聚形成成行星與衛星
- 小天體轟擊對早期行星演化有重大影響
- 目前這些小天體仍不斷與地球相撞
- 是建構太陽系天體的基本「磚塊」，包含了最原始的物質，保留了太陽系形成與早期演化歷史
- 未來最具挑戰的太空任務就是探訪這些小傢伙
  Deep Impact, Rosetta


地面觀測站依序
看到掩星現象
太陽系邊緣的彗星核
Star
太陽系內圍
古柏帶
銀河系中遙遠恆星
當彗星掩過恆星
星光會短暫消失
Taiwan
America
Occultation
Survey
中美掩星計畫