Teacher Seminar (Astronomy and Space Science)

2014-07-07

Hong Kong Space Museum

Schedule

- 14:00 – 15:15 Part 1
- 15:15 – 15:40 Break/ Resource Centre Opens
- 15:40 – 16:50 Part 2
- 16:50 Resource Centre Opens until 17:10

- http://www.upf.edu/pcstacademy/_docs/The_95x_solution.pdf

The 95 Percent Solution

School is not where most Americans learn most of their science

John H. Falk and Lynn D. Dierking

The scientific research and education communities have long had a goal of advancing the public's understanding of science. The vast majority of the rhetoric and research on this issue revolves around the failure of school-aged children in the United States to excel at mathematics and science when compared with children in other countries. Most policy solutions for this problem involve improving classroom practices and escalating the investment in schooling, particularly during the precollege years. The assumption has been that children do most of their learning in school and that the best route to long-term public understanding of science is successful

museums, zoos, aquariums, national parks, community activities such as 4-H and scouting and many other scientifically enriching enterprises. The sheer quantity and importance of this science learning landscape lies in plain sight but mostly out of mind. We believe that nonschool resources—used by learners across their lifetimes from childhood onward—actually account for the vast majority of Americans' science learning. If this premise is correct, then increased investment in free-choice (also known as informal) learning resources might be a very cost-effective way to significantly improve public understanding of science. Taking this view, though, requires dis-

The unquestioned focus was to increase the quantity of qualified science teachers and by doing so, the quality of teaching. This assumption shaped years of research on the public understanding of science, summarized biannually by the National Science Board in their *Science and Engineering Indicators* series. National organizations such as the American Association for the Advancement of Science and the National Academies of Sciences commissioned white papers focusing on the issue, and science-education reform efforts were funded by the National Science Foundation and the Department of Education.

Over the ensuing years, the content

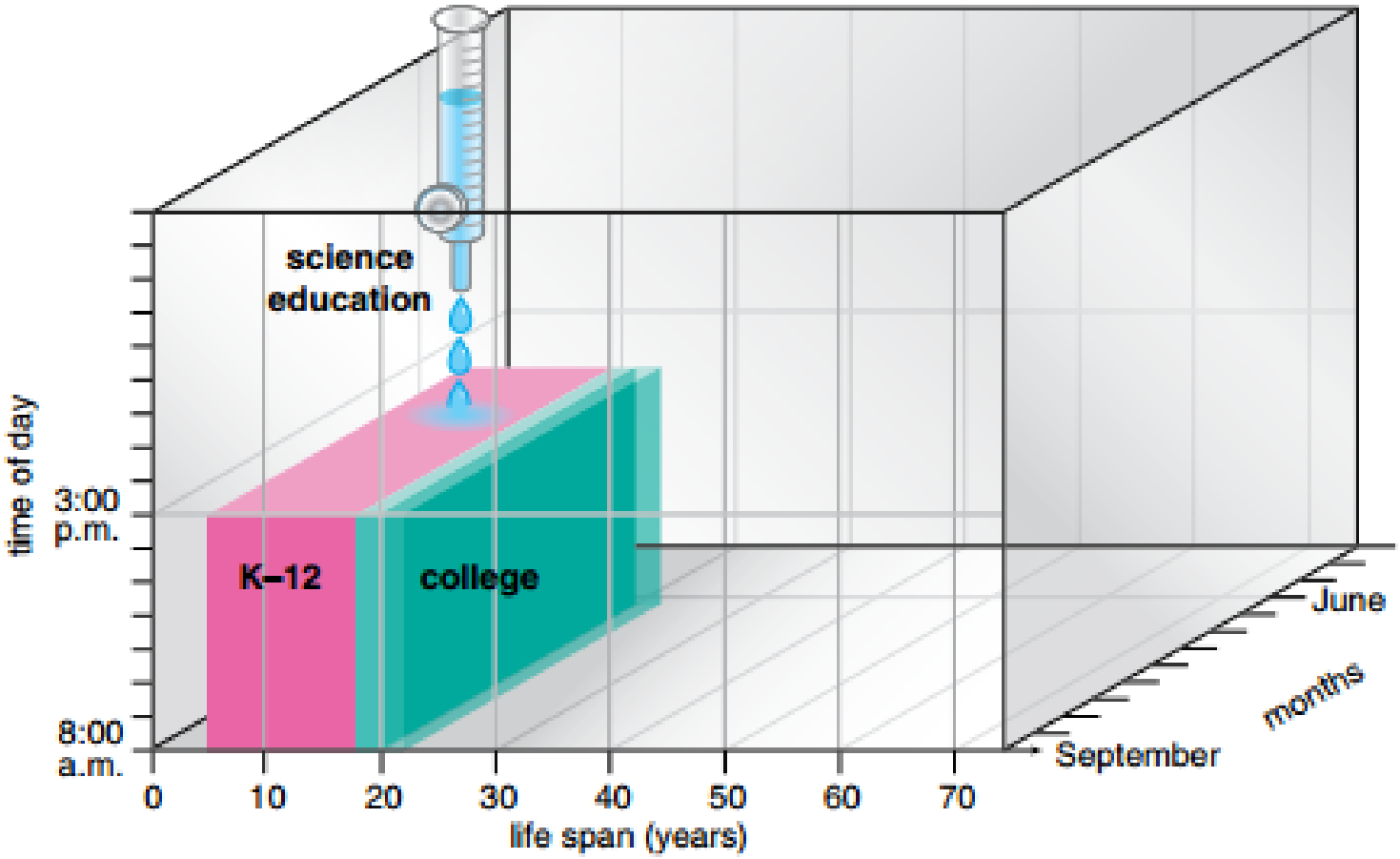
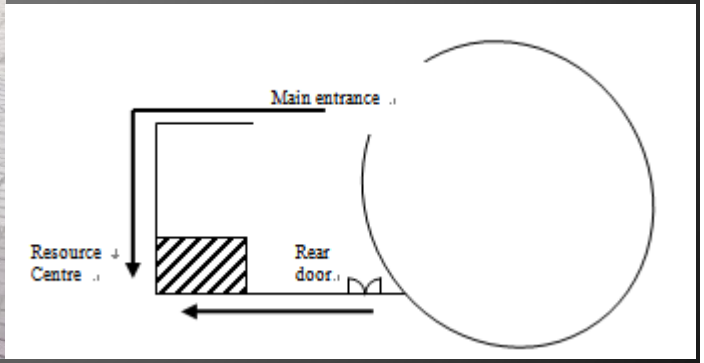


Figure 2. On average, only about 5 percent of an American's lifetime is spent in the classroom, and only a small fraction of that is dedicated to science instruction. Emerging data suggest that the best way to increase the public understanding of science is to reach people during the other 95 percent of their life.

Hong Kong Space Museum

- School programmes
  - School Visit
  - School Show
  - School Culture Day
  - Young Astronaut Training Camp

Resource Centre



Nature of Universe

宇 宙 的 本 質

- *前言*
- *講義*

香港大學

物 理 系

主辦

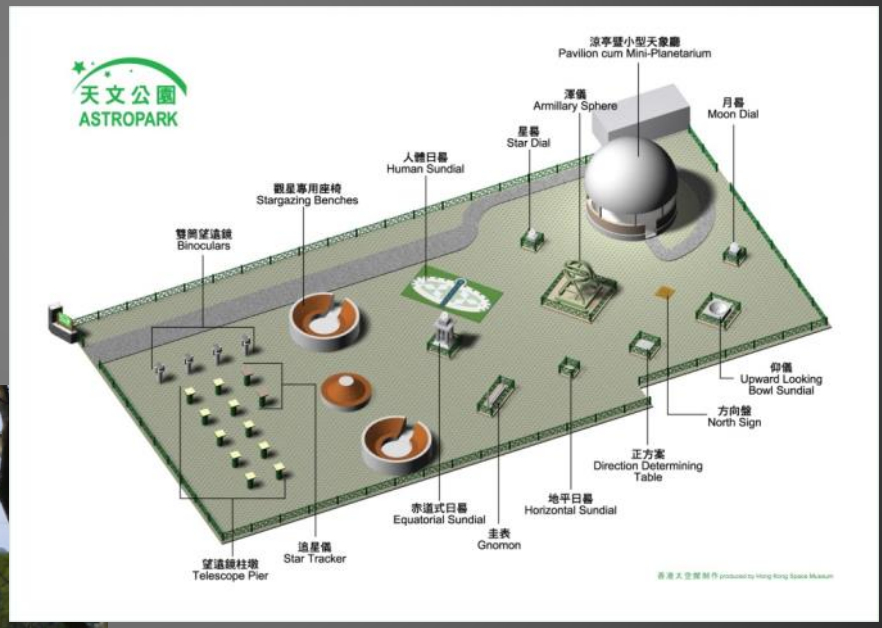
康樂文化署

香 港 太 空 館

協辦

Astropark

- Next to Chong Hing Water Sport Centre, Sai Kung
- Established in 2010
- Attendance
  > 13,000/yr



iObservatory

- Located in Lady Maclehose Holiday Village, Sai Kung
- Established in 2009
- Remote imaging system under development

Weather Information for Astronomical Observation


NEAT搜索全攻略
How to discover new ast
Weather Information for
香港太空館 Hong Kong S
https://www.facebook.com/hkspacem
香港太空館 Hong Kong Space Museum
Patrick
Home
Find Friends
You are posting, commenting, and liking as 香港太空館 Hong Kong Space Museum — Change to Patrick Lau
Page
Activity 20
Insights
Settings
Build Audience
Help
香港太空館 Hong Kong Space Museum
Museum · Landmark
Liked
Following
Message
Timeline
About
Photos
Reviews
More
THIS WEEK
28
Page Likes
2,166
Post Reach
UNREAD
20
Notifications
0
Messages
Recent
2014
2013
2012
2011
Opened
GAMES OF FRIENDS
MORE
RECOMMENDED GAMES
Casey Kc Lee likes 852 郵報's link.
Eric Ng likes Lai Chi Ming's post in HKAS香港天文學會.
Sai Hang Donald Tsui likes Lawrence W.K. Lee's status.
Gigi Ng likes Lawrence W.K. Lee's status.
Spencer Lam likes Jeff Yung's status.
So Chu Wing
Turn on chat to see who's available.
Search
PEOPLE
#1 Museum in Kowloon
6,633 likes
30,712 visits
Sui Sun Kong, Kelvin Chung and 43 other friends like this or have been here.
Status
Photo / Video
Offer, Event +
What have you been up to?
24 Scheduled Posts. View posts.
Next post scheduled for tomorrow at 9:00am
香港太空館 Hong Kong Space Museum
Posted by Natalie Leung · July 4 · Edited
608.cfg
566.cfg
644.cfg
EDBJuly2.ppt
顯示所有下載...

Coming soon…

- Mobile app

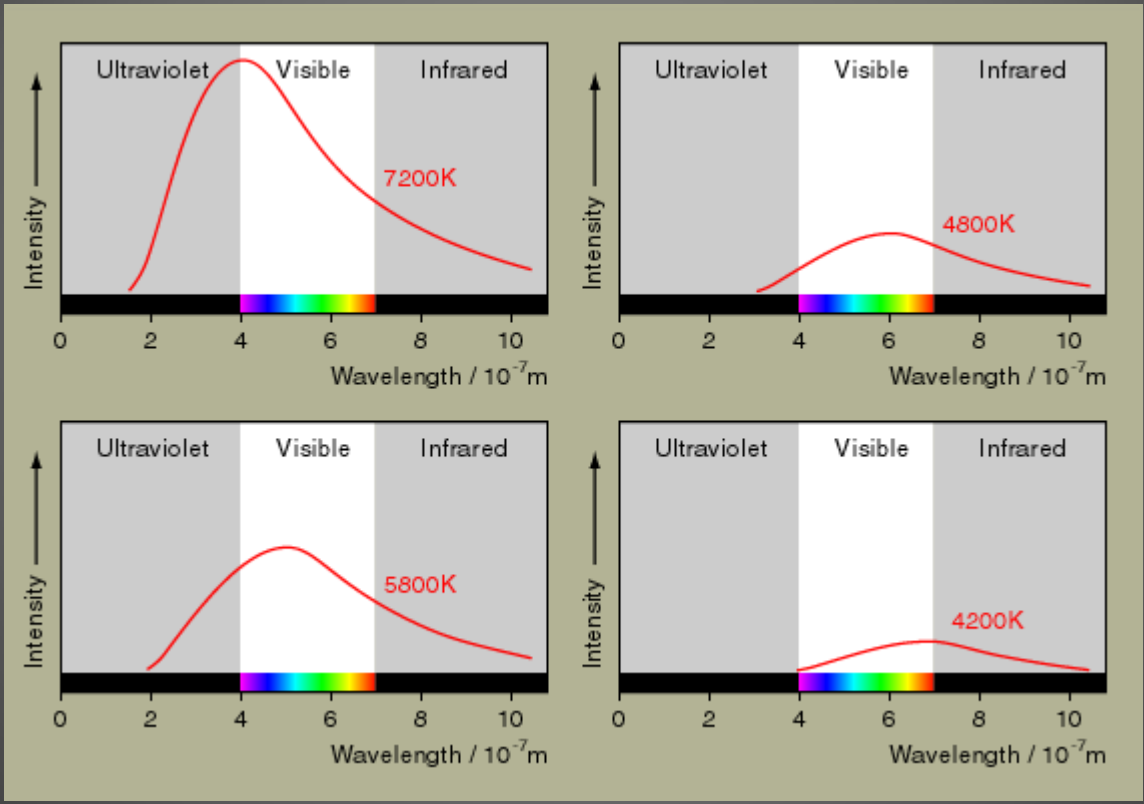
- New school shows

Activities

- Explorative
- No definitive goal

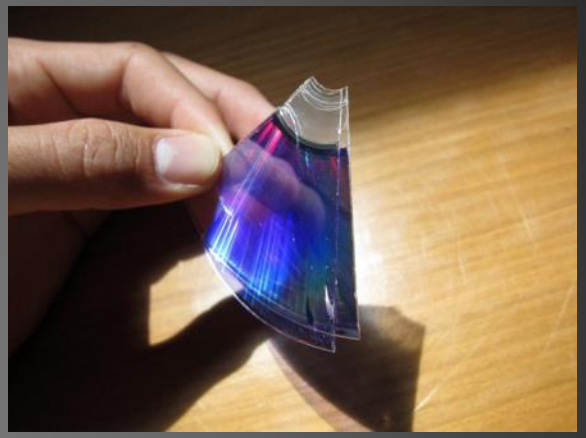
Stars and the universe

Stellar classification: Stellar Spectrum



1. Classroom Spectroscopy

- Personal
  (really saw the spectrum?)
- Hard to calibrate for
  quantitative study



Recent development

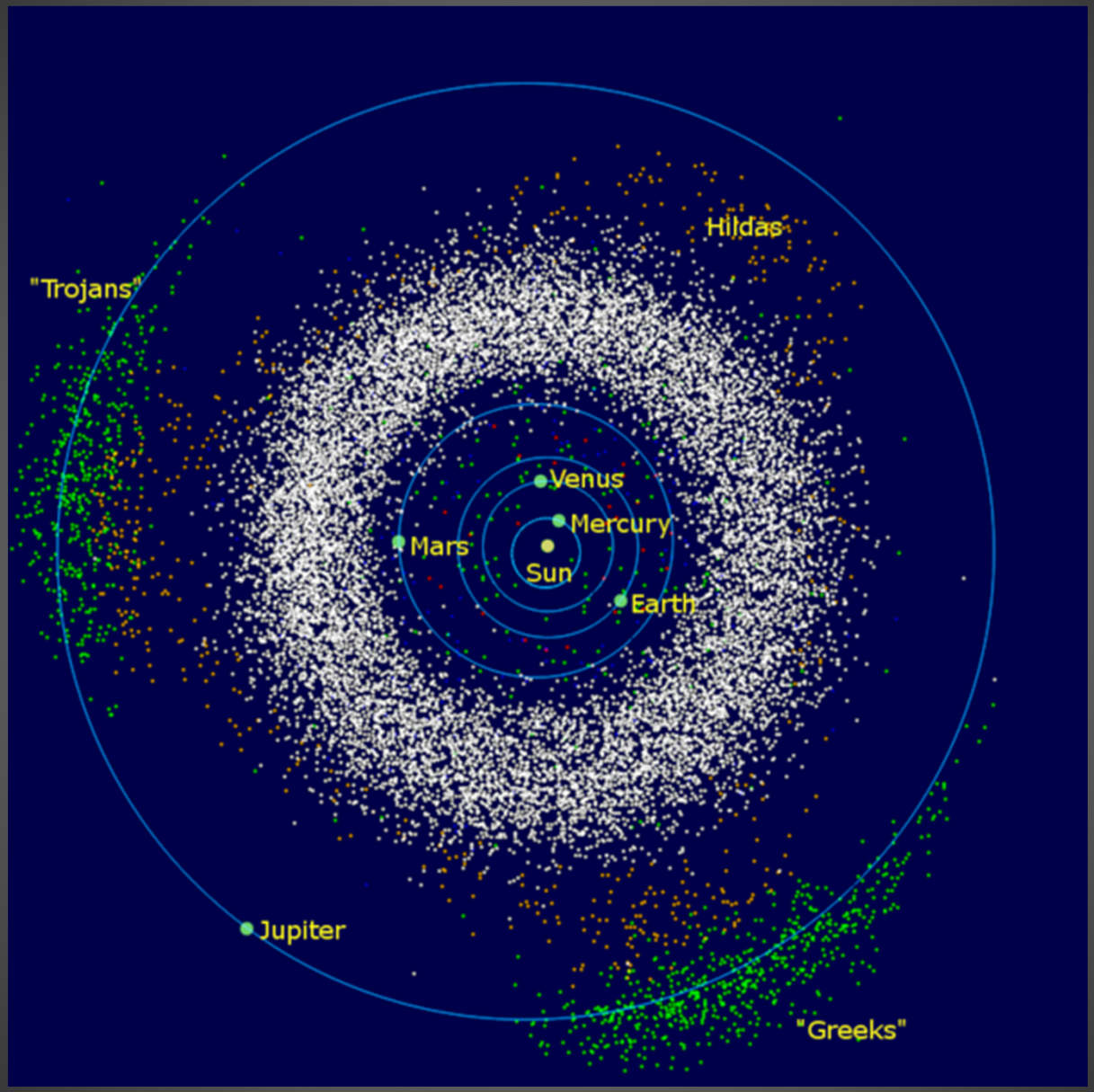
- Real-time
- Can be seen by whole class
- Easy calibration

Credit: Physics Lab

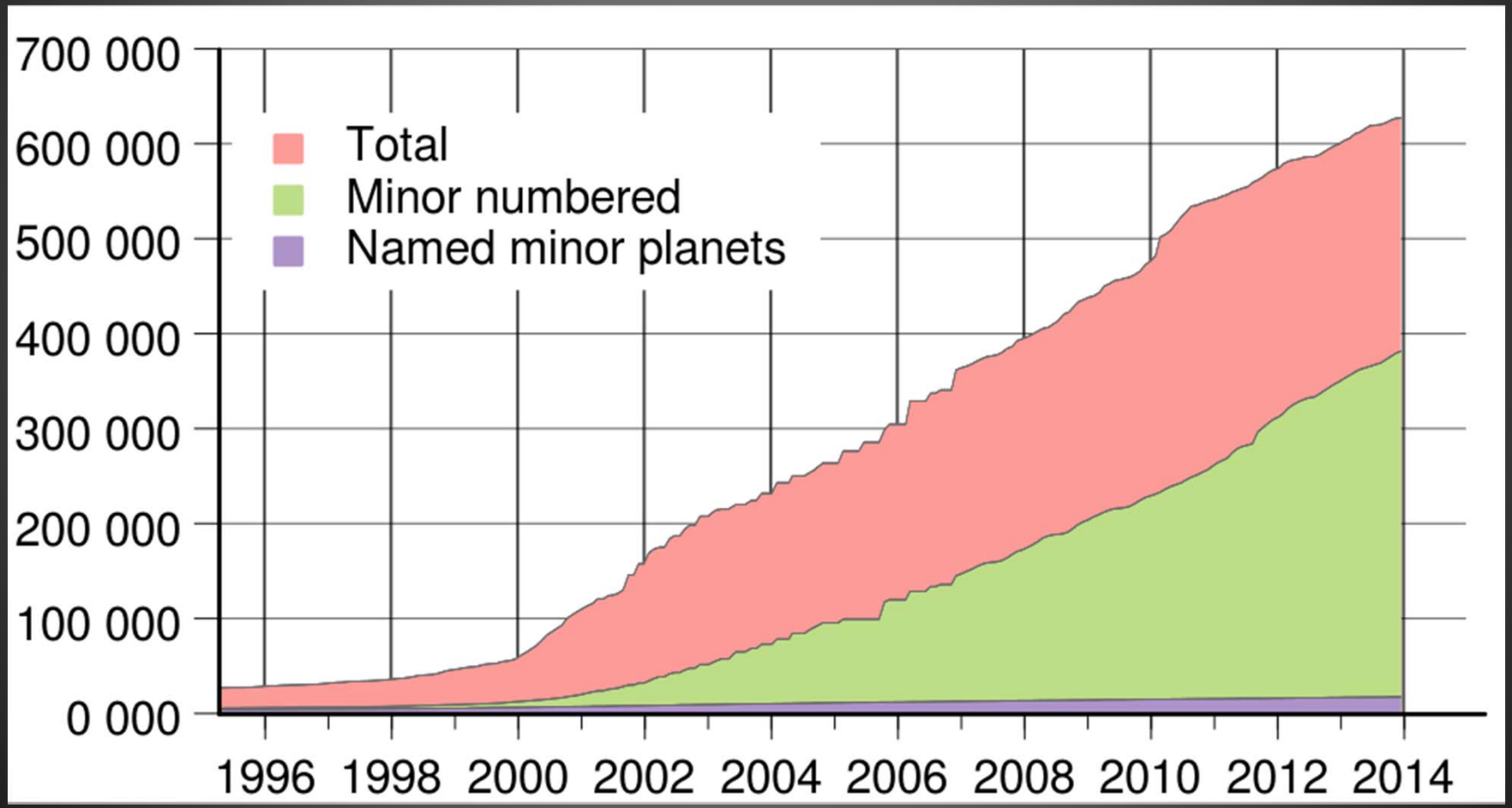
Credit: Physics Lab

2. Estimate the coordinates of asteroid and analyze their orbit using standard astronomical software

Credit: NASA/JPL-Caltech/JAXA/ESA



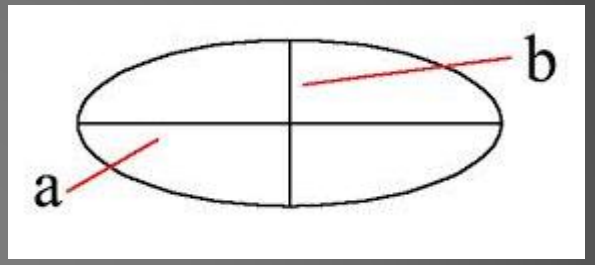
Credit: Wikimedia Commons



Credit: Wikimedia Commons

Coordinate → Orbit

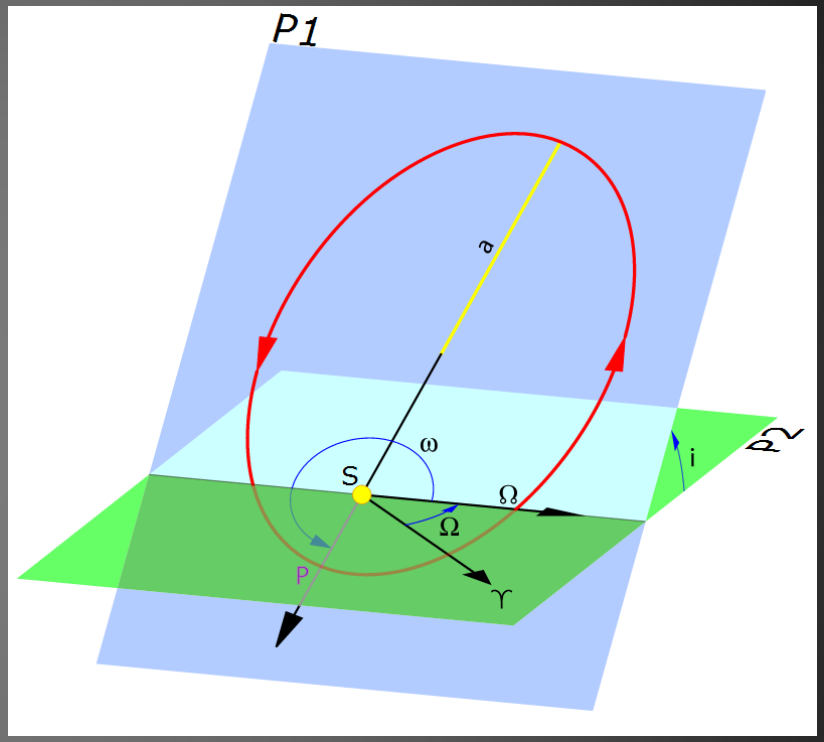
- Right ascension and declination
- Ellipse $\left(\frac{x}{a}\right)^2 + \left(\frac{y}{b}\right)^2 = 1$



- But how to express asteroid orbit in space?

Orbital Elements

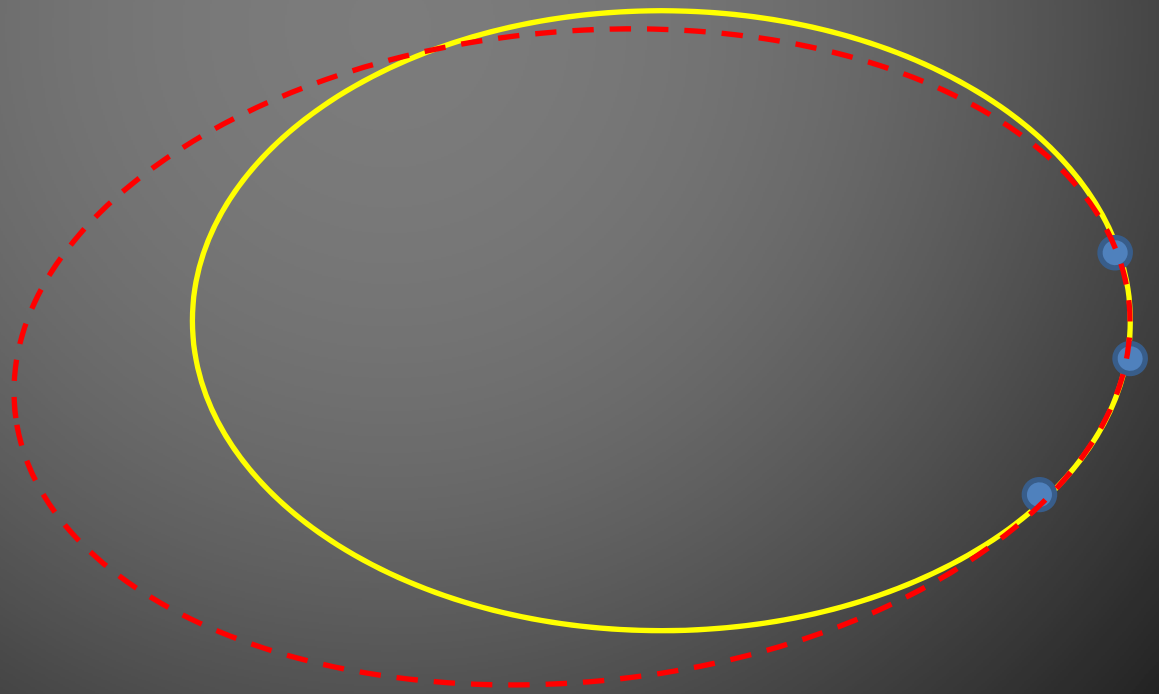
- a (semimajor axis)
- e (eccentricity)
- i (inclination)
- Ω (longitude of ascending node)
- ω (argument of perihelion)
- M (mean anomaly at epoch)



Credit: Wikimedia Commons

Orbit determination

- At least 3 separate observations to obtain an orbit.
- But observation error…



Minor Planet Ephemeris Service: Query Results

Below are the results of your request from the Minor Planet Center's Minor Planet Ephemeris Service. Ephemerides are for the geocenter.

2006 AS3

Display all designations for this object / # of variant orbits available = 3

```
Epoch 2014 May 23.0 TT = JDT 2456800.5                  MPC
M 111.97431              (2000.0)            P              Q
n   0.63704219     Peri.  245.46726     -0.97226698     -0.08217864             T = 2456624.72780 JDT
a   1.3376955      Node   289.20434     +0.17658686     -0.87180750             q =     0.8966085
e   0.3297364      Incl.   13.40678     -0.15334277     -0.48290615    Earth MOID = 0.04314 AU
P   1.55           H   24.7           G   0.15           U   7
From 40 observations 2006 Jan. 7-10, mean residual 0".51.
```

Residuals

20060107	691	0.4+	0.5-	20060107	143	0.1-	0.5-	20060108	291	0.1+	0.0
20060107	691	0.2+	1.1-	20060107	143	0.4-	0.2-	20060108	G96	0.2+	0.5-
20060107	691	0.1+	0.7-	20060107	J77	1.2-	0.8-	20060108	291	0.3+	0.3+
20060107	291	0.1+	0.6+	20060108	673	0.5+	1.1+	20060109	291	0.0	0.2+
20060107	291	0.1+	0.8+	20060108	673	0.2+	0.6-	20060109	291	0.2+	0.2-
20060107	291	0.2-	0.8+	20060108	673	0.5-	1.1+	20060109	291	0.0	1.1+
20060107	291	0.1+	0.8+	20060108	673	0.5+	0.5-	20060110	291	0.1-	0.1-
20060107	291	(1.0+	2.5+)	20060108	734	0.2-	0.1+	20060110	291	0.2-	0.4-
20060107	291	0.5+	0.9+	20060108	734	(1.4-	3.0-)	20060110	291	0.1-	0.4+
20060107	J77	0.3+	0.8-	20060108	734	0.0	0.6+	20060110	118	0.0	0.2-
20060107	118	0.5-	0.4-	20060108	G96	0.0	0.5-	20060110	118	0.1+	0.5-
20060107	118	0.0	0.1-	20060108	G96	0.2-	0.3-	20060110	118	0.2-	0.8+
20060107	118	0.2+	0.1-	20060108	291	0.2+	0.4+	20060110	118	0.2+	0.2-
20060107	118	0.3+	1.7+	20060108	G96	0.1+	0.3-	20060110	118	0.1+	0.0

Last observed on 2006 Jan. 10. Perturbed ephemeris below based on elements from *MPO* 98073.

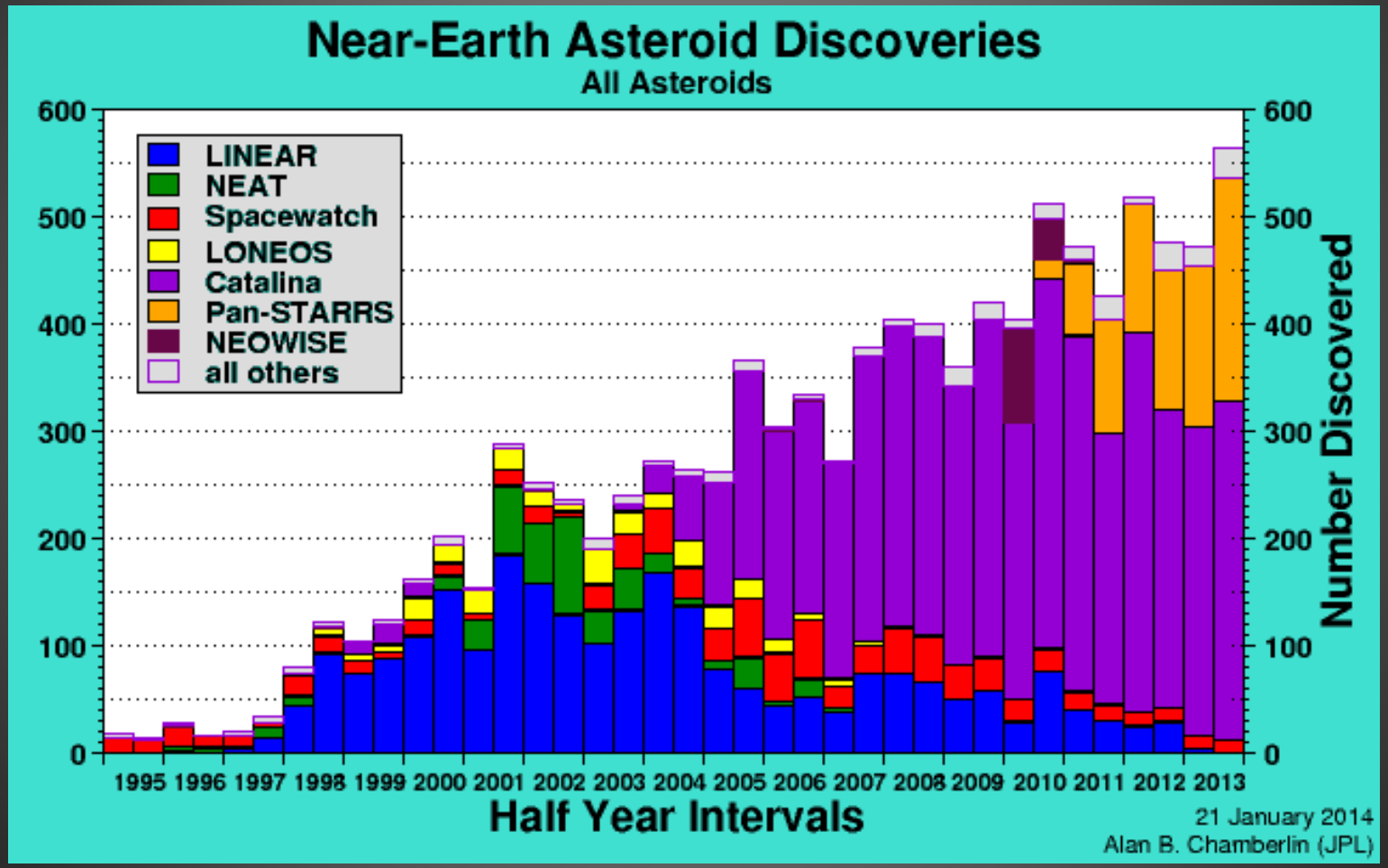
```
     K06A03S       [H=24.7]
Date        UT      R.A. (J2000) Decl.    Delta     r     El.    Ph.   V      Sky Motion       Uncertainty info
            h m s                                                            "/min    P.A.    3-sig/" P.A.
```

Scientific importance

- Discovery
- Pre-covery
- Recovery

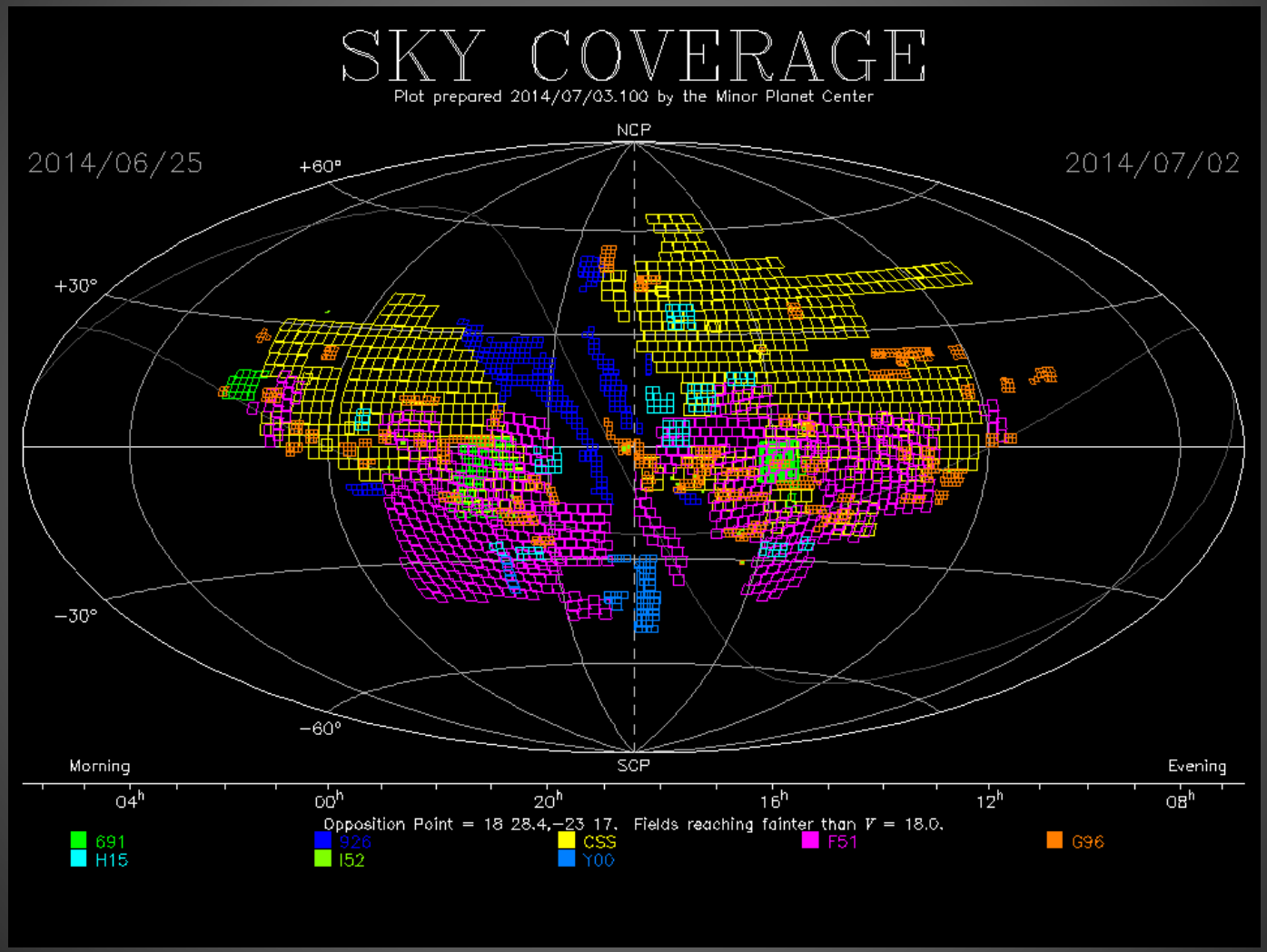
General Workflow

- Take photos of a region of sky at certain intervals
- Look for moving dots
- Check for existing objects
- Extract coordinates if not
- Compute initial orbit
- Find it again few days later and refine orbit
- Report to Minor Planet Center
- Maybe a long lost asteroid or new one



Credit: Jet Propulsion Laboratory

If you can’t beat them…



Credit: Minor Planet Center

Join them…

字級：A- A A+

頭條要聞〉 好讚 台高中生發現稀有小行星

分享到FB 分享到g+ 分享到Plurk 分享到Twitter

好讚 台高中生發現稀有小行星

2014年06月04日 讚 136 g+1 1

泛星計劃共同主持人陳文屏（前排左二），與發現半人馬小行星的興大附中學生合影。中央大學提供

【許敏溶／台北報導】台灣學生好棒。中央大學天文所教授陳文屏帶領台灣高中生，參與全球搜尋小行星活動獲重大成果，北一女中及中興大學附屬中學學生發現兩顆小行星，其中興大附中發現稀有的半人馬小行星，更是史上首次由高中生在古柏帶區域發現的小行星，陳文屏直呼：「非常難得。」

7國40校參與搜尋

國際天文搜尋聯盟今年三月十四日到四月十八日，舉行泛星計劃小行星搜尋活動，台灣、美國、德國等七國近四十校學生參與，台灣有北一女中、興大附中、彰化高中、羅東高中、惠文高中五校

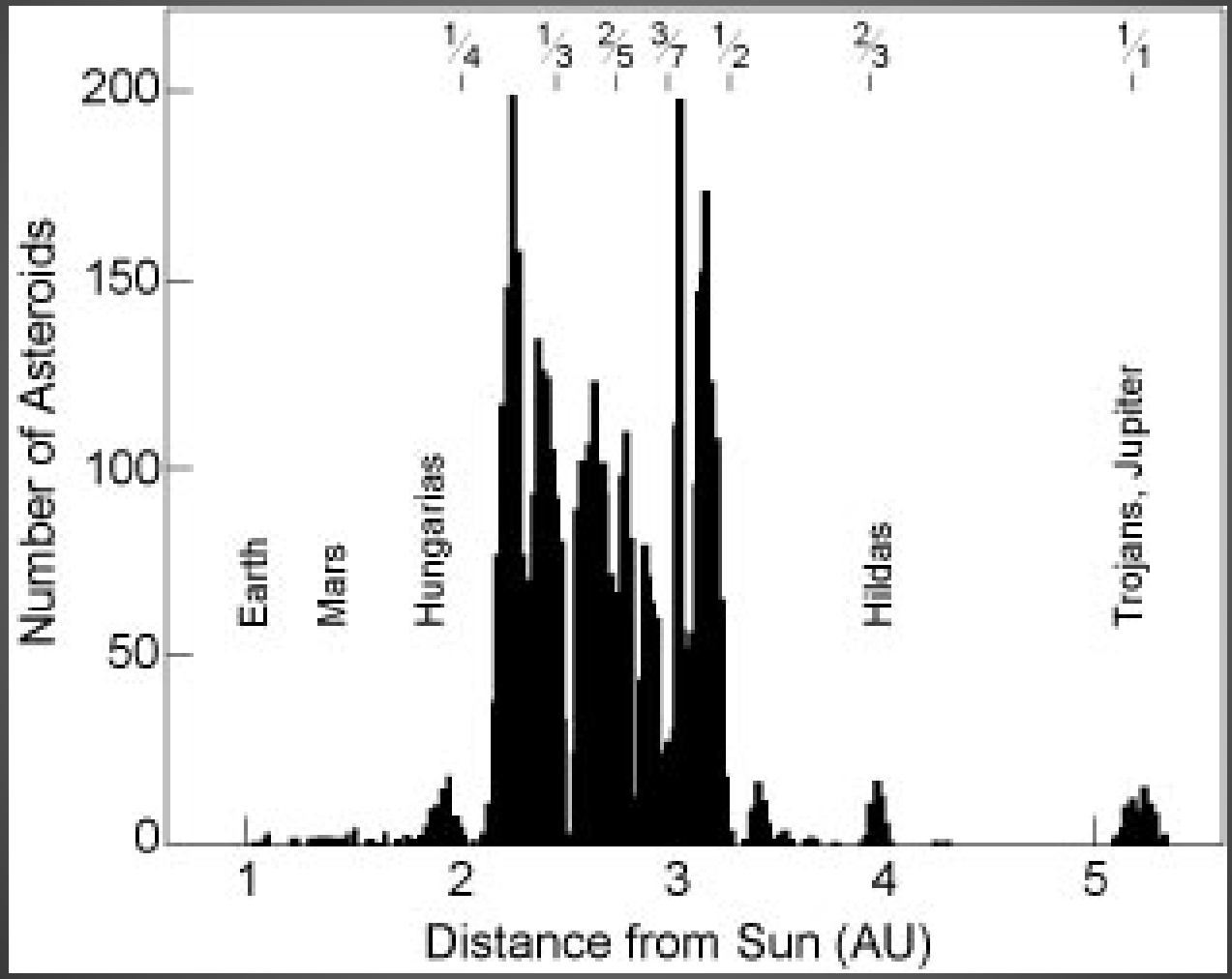
Credit: Taiwan Apple Daily

Workflow for classroom

- Get images from sky surveys (e.g. Skymorph)
- Look for moving dots
- Check for existing objects
- Extract coordinates if not

(e.g. Astrometrica)

- Compute initial orbit (e.g. Find_Orb)
- Find it again few days later and refine orbit(e.g. Skymorph)
- Report to Minor Planet Center (e.g. Astrometrica)
- Maybe a long lost asteroid or new one



Credit : Minor Planet Center

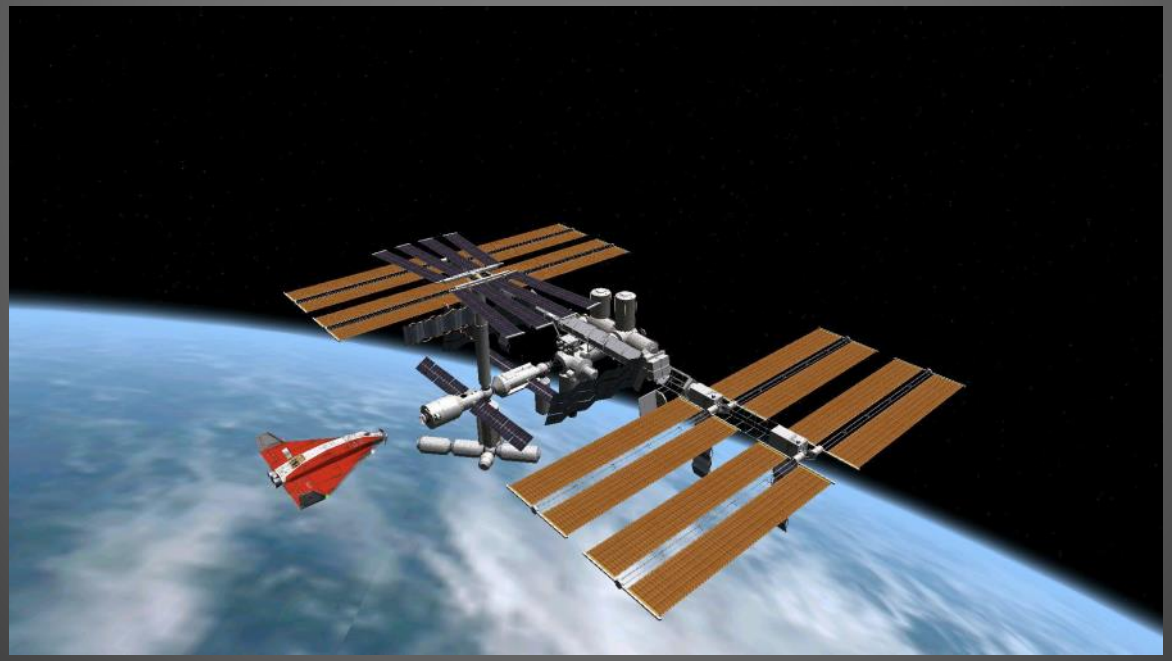
Good resources

- http://www.xjltp.com/9_neat/neat.htm
- http://www.skaw.sk/enhuntpage.htm

3. Orbital motions under gravity

- Orbiter

  - a free spacecraft simulation tool



Credit: Martin Schweiger

Merits

- Free!
- Realistic
- Suitable for different levels of users
- Not too CPU intensive
- Customizable

Use in classroom

- Playback of space missions
- Force analysis
- Maneuvers e.g. docking, orbit changing, etc.

Credit: Martin Schweiger

Resources

- Go Play In Space http://www.orbiter.migman.com/orbiter.php