天文 X STEM

中天訓 WORKSHOP 4

PREPARED BY RAVEN LAU

DATE: MARCH 21, 2019

OUTLINE

Demo/Experiment

Workshop

Stargazing

Talk/booth

Sharing

DEMO/ EXPERIMENT

COMET MOON CRATER

在實驗室裏製作彗星、模擬月球隕石坑的形成

ASTRONOMICAL PHENOMENA

模擬各種天文現象：月亮盈虧、日 / 月全蝕

STARRY NIGHT METEOR SHOWER

星空模擬、流星雨ZHR

ASTROPHYSICS

協助同學去理解較抽象的物理理論：超新星爆炸、重力……

COMET

WARNING

注意事項

實驗中會使用到乾冰，因此必須有老師在場。

DRY ICE

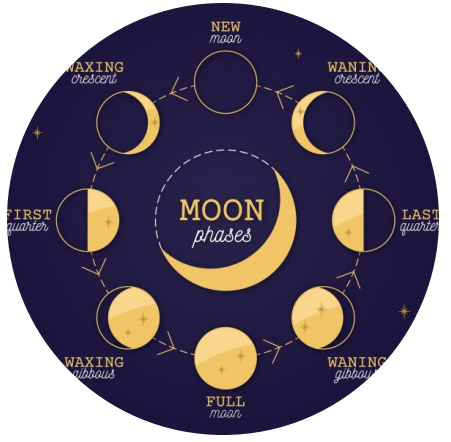
WARNING

注意事項

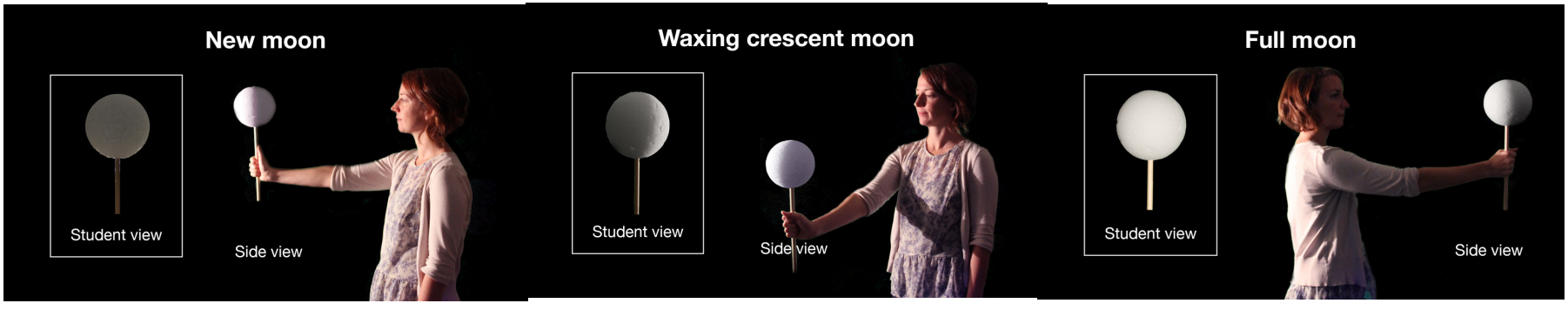
小心凍親

MOON CRATER

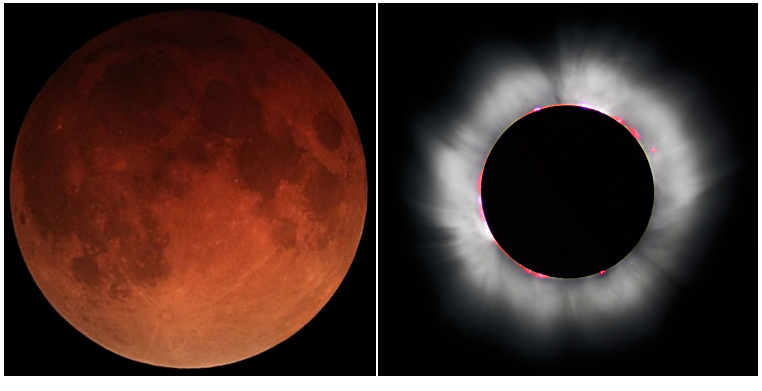
ASTRONOMICAL PHENOMENA



月亮盈虧

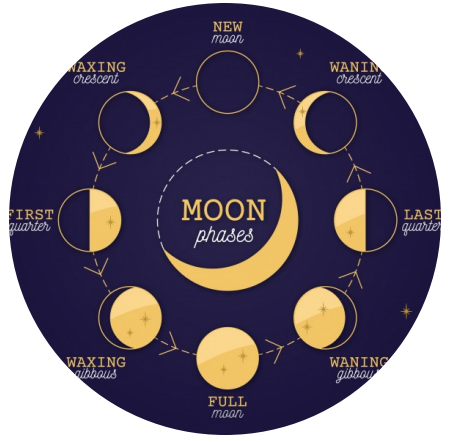


月 / 日全食

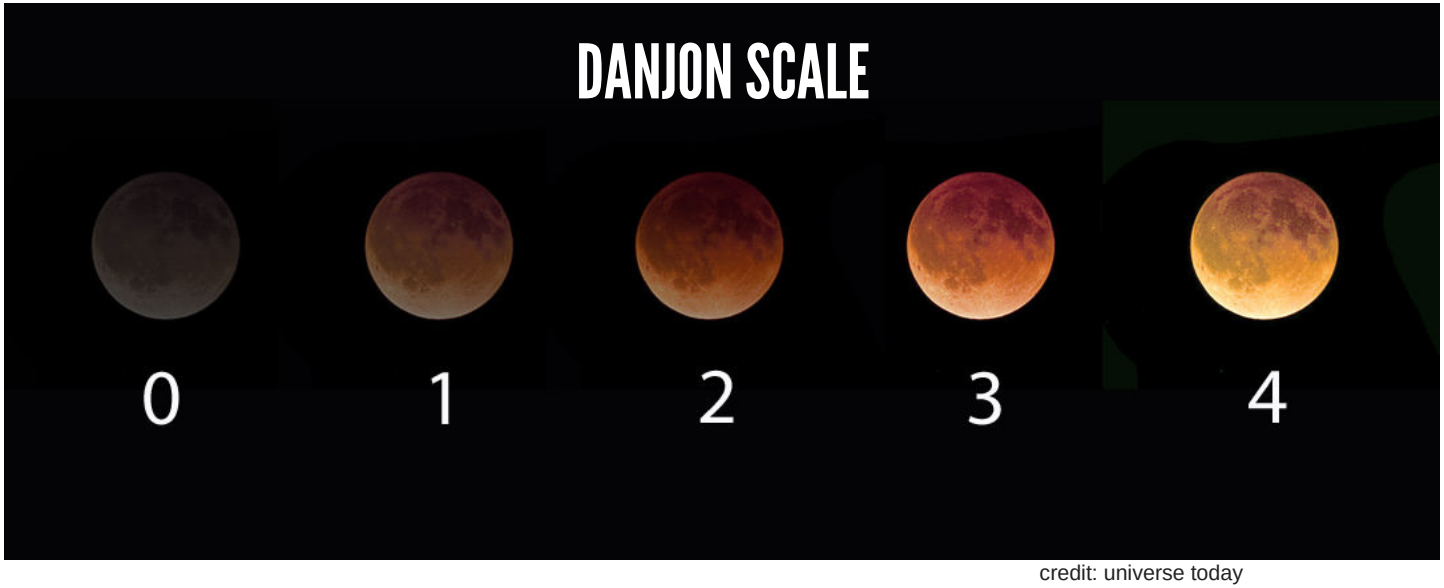


credit: science in school

ASTRONOMICAL PHENOMENA



月全食



credit: universe today

STARRY NIGHT

數碼立體星象館

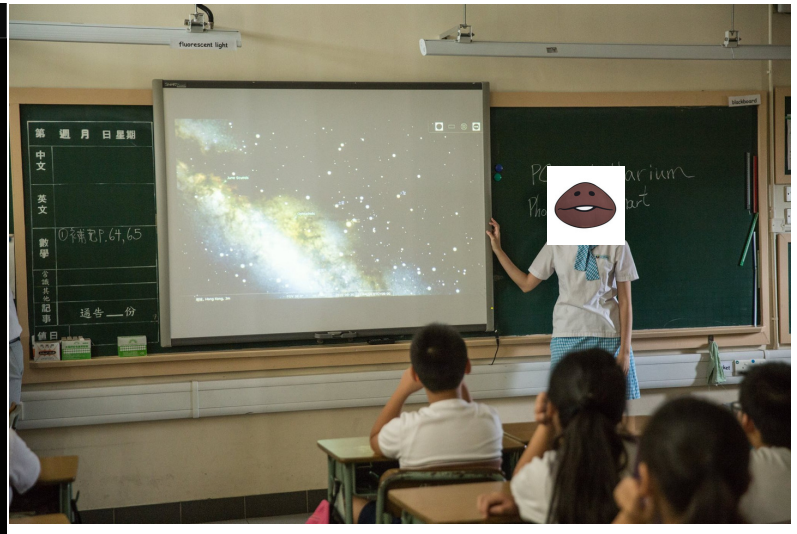
REMIND

溫馨提示

星象館可向可觀自然教育中心□天文館借用。記得留意星象館大小是否能於校內場地安置。

STARRY NIGHT

stellarium



INTRODUCTION

軟件介紹

電腦版是免費的。可模擬當晚及不同日子的星空，包括特別的天文現象，例如凌日，日食等等（彗星除外）。此外，可以放大觀察不同行星，深空天體。

METEOR SHOWER

ZHR (ZENITHAL HOURLY RATE)
每小時天頂流星數

：在高峰時期，假設流星輻射點在天頂位置，全天100%無遮擋視野，肉眼可見6.5等星的情況下，觀察者可看到的流星之每小時出現頻率。

$$ZHR = \frac{\overline{HR} \cdot F \cdot r^{6.5-lm}}{\sin(hR)}$$

METEOR SHOWER

英仙座流星雨

Given:

1) ZHR 100
2) 20% of the observer 's field of view was covered by clouds
3) r=2
4) lm = 4
5) hR = 27 deg

$$ZHR = \frac{\overline{HR} \cdot F \cdot r^{6.5-lm}}{\sin(hR)} \qquad F = \frac{1}{1-k}$$

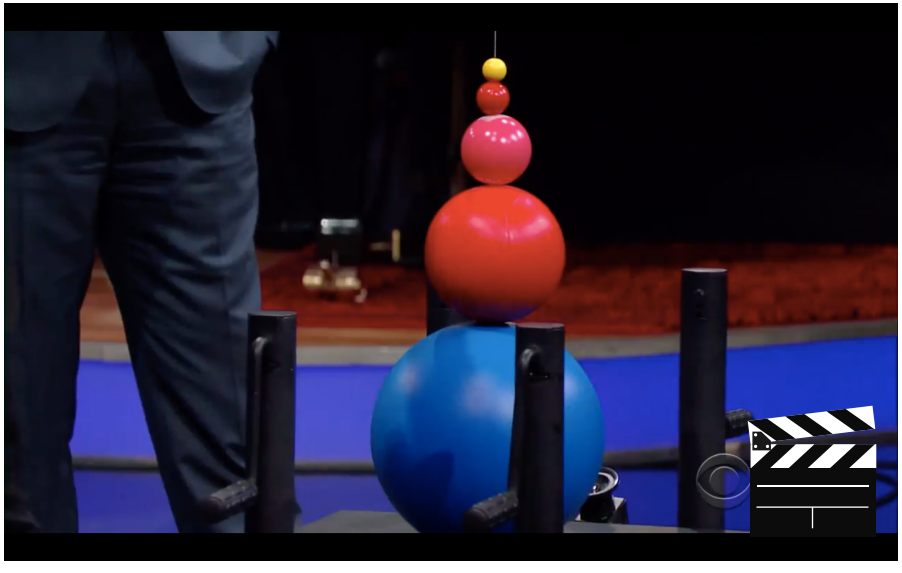
k = fraction of the sky which you cannot see

lm = the observer's limiting magnitude

ASTROPHYSICS

重力

超新星



REMIND

溫馨提示

有些同學比較不擅長理解較抽象的物理概念，利用實驗 / 示範去協助同學理解相關理論是較好的方法。

WORKSHOP

SUN FUNNEL

自製太陽濾光片及投影儀

MODEL

用紙製作跟天文相關的模型，例如太空望遠鏡、行星等等。甚至用3D打印技術製作模型

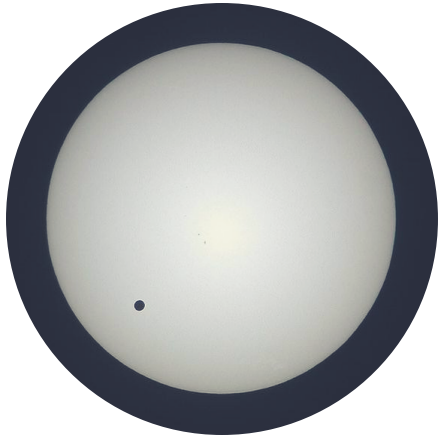
REFRACTING TELESCOPE

製作伽利略望遠鏡，從中明白折射式望遠鏡的原理

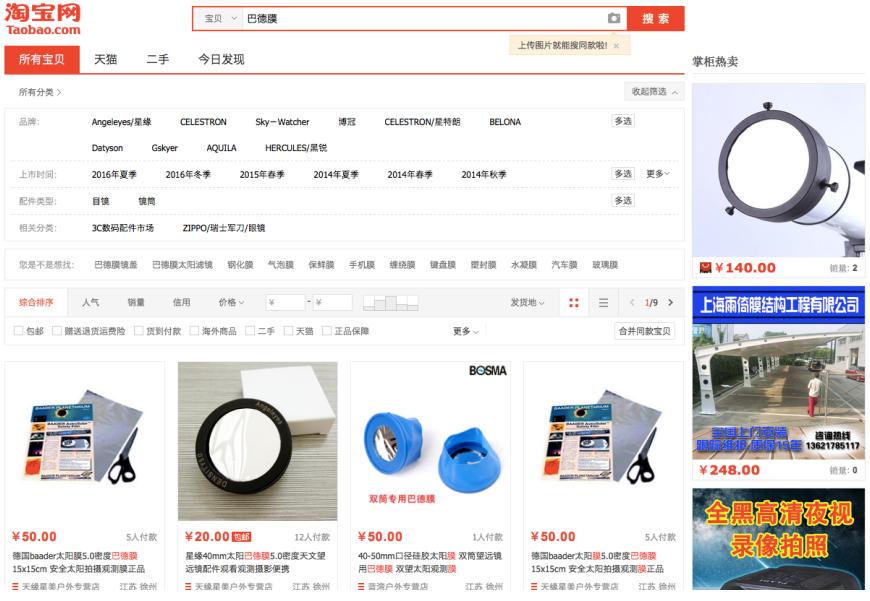
SPECTROSCOPE

光譜儀是宇宙探索中不可缺少的儀器。學習制作簡易的光譜儀。

SUN FUNNEL



太陽濾光片 / 巴德膜



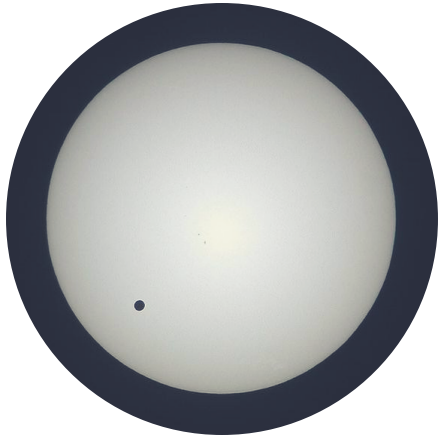
REMIND

溫馨提示

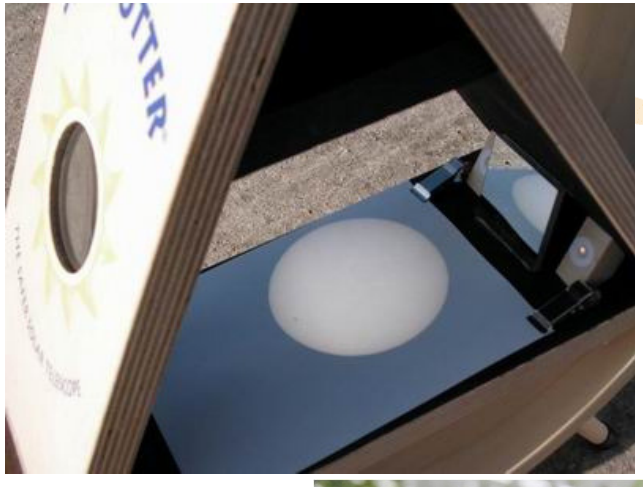
訂購巴德膜時要注意密度，5.0才是適合用作肉眼觀測。

使用前檢□有沒有漏光情況。

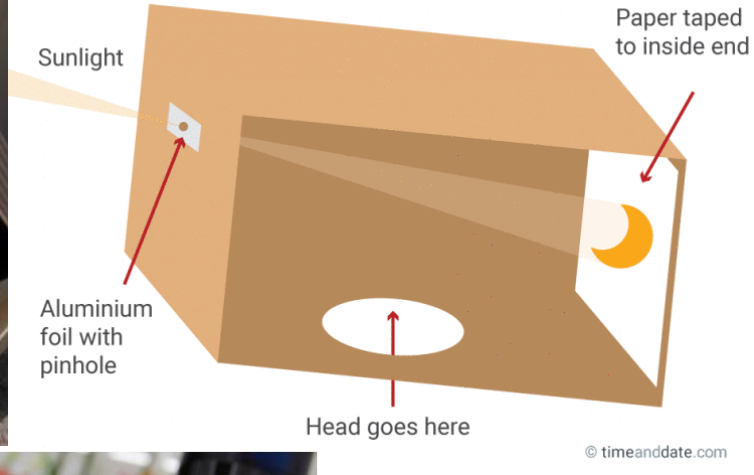
SUN FUNNEL



投影儀



針孔投影儀

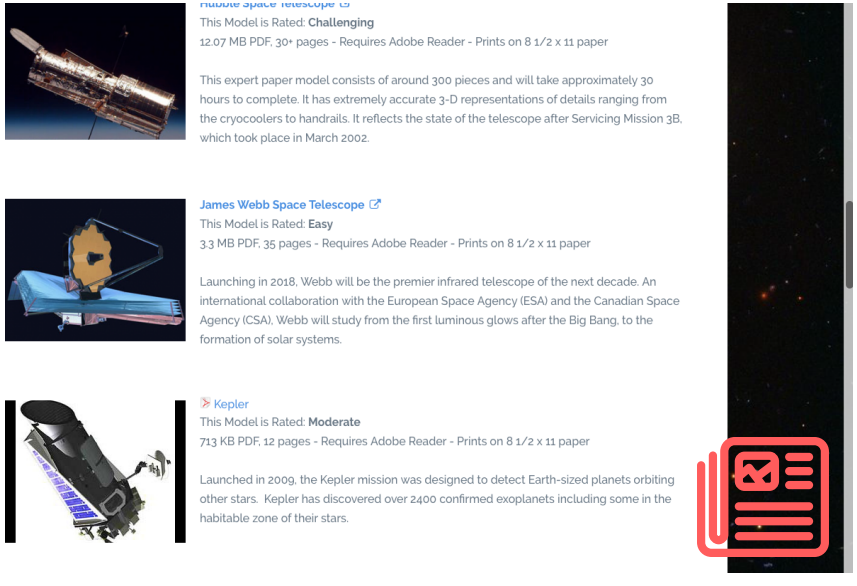


credit: timeanddate.com

PAPER MODEL

紙模型製作

香港太空館：天文資訊：教育資源：下載製作紙



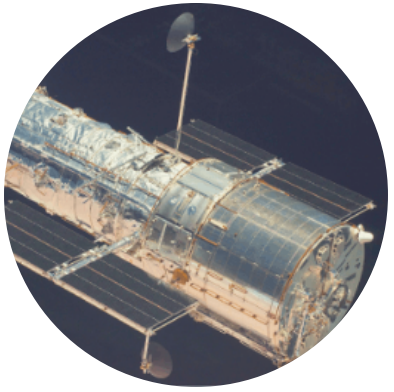
NASA paper models

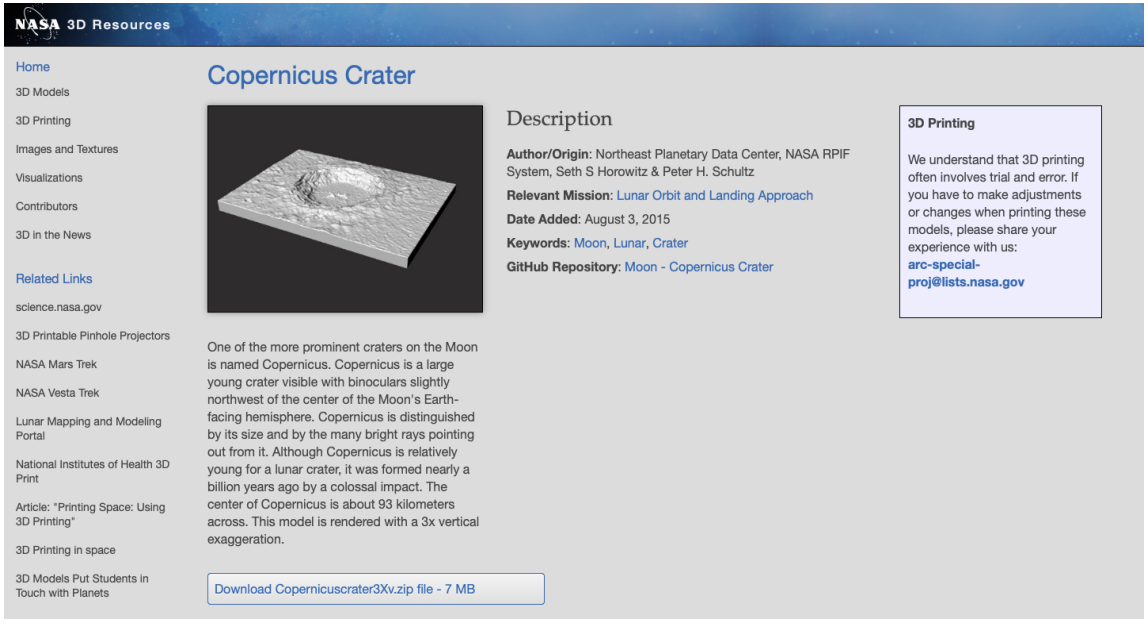
REMIND

溫馨提示

利用像卡紙這種較厚的紙來製作紙模型效果更佳。每個模型製作時間和難度均不同，最好活動前先自行製作一次。

3D PRINTING MODEL





NASA 3D Resources

INTRODUCTION

網頁介紹

網頁中有許多模型可作打印，包括隕石坑、太空探測器等等

REFRACTING TELESCOPE

製作折射式望遠鏡

INTRODUCTION

工作坊介紹

折射式望遠鏡結構較簡易，適合協助中學生去理解望遠鏡原理。製作後可讓同學利用望遠鏡眺望遠的景物，明白折射式望遠鏡的優缺點（如色差）。

REFRACTING TELESCOPE

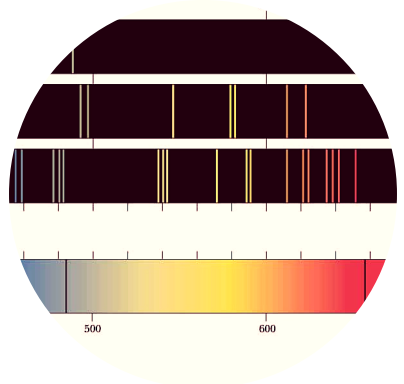
製作折射式望遠鏡

INTRODUCTION

工作坊介紹

購買凹凸透鏡自行組裝。

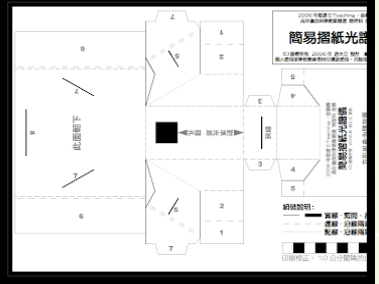
SPECTROSCOPE



製作光譜儀

製作方法:

1. 請先下載展開圖,



2. 以96dpi解析度, 不要做任何的縮小或放大, 列印在厚紙板上。
3. 厚紙板的厚度以能不透光, 並且放入印表機或影像機列印為原則。
4. 組裝過程, 請參閱【簡易摺紙光譜儀】的照片說明。
5. 組裝過程也可以參考下面的影片:

INTRODUCTION

工作坊介紹

Google「大凡化宇宙：簡易摺紙光譜儀」/
香港太空館：天文資訊：教育資源：下載製作紙：簡易CD光譜儀可找到模型平面圖及教學

STARGAZING

NAKED-EYE OBSERVATION

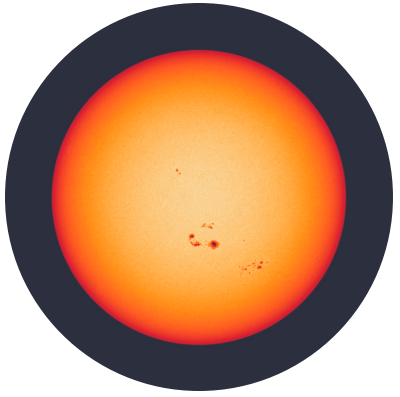
普通單憑肉眼觀察

THROUGH TELESCOPE

透過雙筒 / 各式天文望遠鏡去觀察

NAKED-EYE OBSERVATION

太陽



credit：The Straits Times

credit：space.com

REMIND

太陽觀測提醒

設置望遠鏡時小心同學仔走近，提醒同學不要直望太陽。

NAKED-EYE OBSERVATION

星座

credit：staples

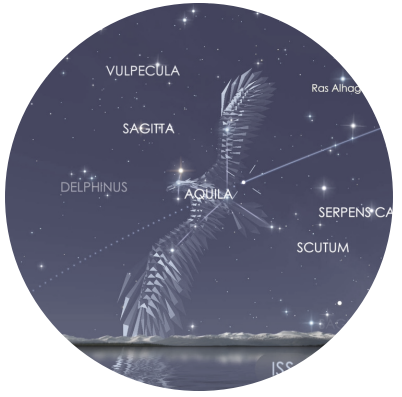
INTRODUCTION

觀星介紹（1）

活動前準備當晚星空會出現甚麼較顯眼的星座。除了指出星座的形狀之外可準備一些相關的神話故事，令同學留下較深刻印象。講星的同時用指星筆會更好。

NAKED-EYE OBSERVATION

觀星軟件



Sky Chart

Star walk

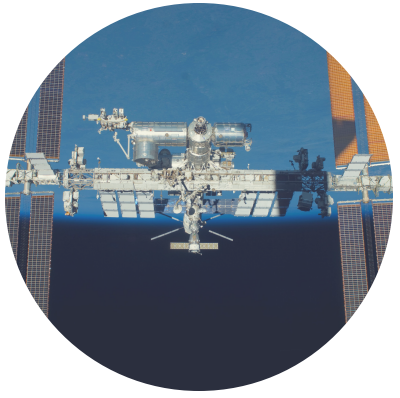
INTRODUCTION

觀星介紹（2）

推介同學下載觀星軟件，方便同學辨認星座。

NAKED-EYE OBSERVATION

人造衛星



The Astronomical Calendar
Observation Planning - Historical Research - Events
Sun - Moon - Planets - Asteroids - Comets - Deep-Sky - Satellites - and more...

Setup | Calendar | Sun | Moon | Planets | Comets | Asteroids | Meteors | Deep-Sky | Satellites

→ Select from menu above! → to long Table of Contents → Nightvision-Mode

You have not yet specified your observing site. You can do so →here, or using the menu entry "Intro", or by clicking the small Earth icon on the right side.

City Of Victoria, Hong Kong
Easting: 114.15
Northing: 22.291
Time zone: UT
Hobby
Th Fr Sa Su
Weather
Local Sponsors: Your name?

Next Launches

Wednesday 21 March 2018
Superbird 8/DSN 1/ Hylas 4 Ariane 5 Launch
Soyuz MS-8 Soyuz-FG Launch (International Space Station 545)

Today at Calsky

meteor streams	51
comets	965
astronomy shops	685
star parties/events	160
satellites	26239
solar/lunar eclipses	23332
deep-sky objects	1100000
asteroids	755698
occultations	4441937
phenomena	15213579
satellite elements	32023484
geographical	

Current Topics

- **See the International Space Station ISS** as it silently crosses the sky during visible passes - an easy target to the naked eye.
- Have you ever wanted to see the ISS cross the front of the Sun or Moon yourself? Here you get accurate predictions for these rare events (looking at the Sun requires proper safety equipment). Get a larger chance by traveling to transits taking place within 25 km. Even want to try to catch the ISS occulting a planet or a bright star?

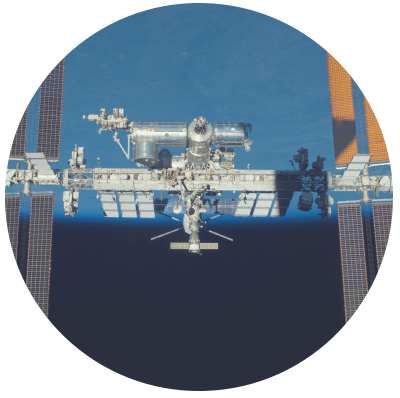
  Another bright objects orbiting the Earth are **Tiangong-1** and **Tiangong-2**.

  See some flashes from **Humanity Star** in the twilights. But hurry, the disco ball will decay before the end of March. Flashes are as bright as 0 mag.
- **Try out our E-mail Alert Manager**. You first need to register and give your e-mail address; it's free – then you can subscribe to aurora alerts, good ISS passes and Iridium flares, satellites and ISS transiting the Sun or planets, your detailed daily celestial calendar, or simply get warned of the full Moon by e-mail.

Calsky

NAKED-EYE OBSERVATION

國際太空站（ISS）



Thursday 11 April 2019

Time (24-hour clock)	Object (Link)	Event
11h46m26s	ISS →Ground track →Star chart	Appears 11h41m06s 1.3mag az:325.4° NW horizon at Meridian 11h45m39s -3.1mag az: 0.0° N h:40.7° Culmination 11h46m26s -3.9mag az: 49.0° NE h:53.2° distance: 503.3km height above Earth: 409.4km elevation of Sun: -15° angular velocity: 0.90°/s Disappears 11h47m24s -3.6mag az:103.9° ESE h:36.7° Time uncertainty of about 22 seconds

Friday 12 April 2019

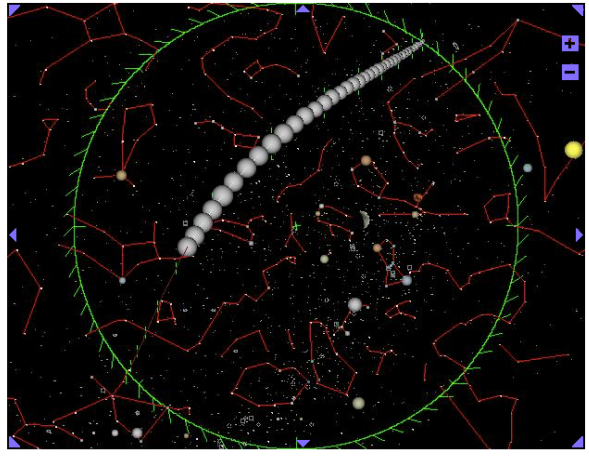
Time (24-hour clock)	Object (Link)	Event
10h55m34s	ISS →Ground track →Star chart	Appears 10h50m31s 0.8mag az:335.2° NNW horizon at Meridian 10h53m38s -1.3mag az: 0.0° N h:14.4° Culmination 10h55m34s -2.7mag az: 45.8° NE h:23. distance: 912.8km height above Earth: 410.0km elev velocity: 0.49°/s Disappears 10h59m17s -1.4mag az:109.6° ESE h:5.3 Time uncertainty of about 26 seconds
12h31m57s	ISS →Ground track →Star chart	Appears 12h27m16s 2.4mag az:296.5° WNW hori Culmination 12h31m56s -1.1mag az:235.4° SW h:15. distance: 1197.9km height above Earth: 408.6km ele velocity: 0.38°/s Disappears 12h32m05s -1.2mag az:232.3° SW h:15. Time uncertainty of about 26 seconds

Saturday 13 April 2019

Time (24-hour clock)	Object (Link)	Event
11h41m14s	ISS →Ground track →Star chart	Appears 11h36m02s 2.2mag az:309.2° NW hori Culmination 11h41m14s -2.4mag az:233.2° SW h:34. distance: 686.3km height above Earth: 408.9km elev velocity: 0.66°/s at Meridian 11h42m57s -2.3mag az:180.0° S h:20. Disappears 11h44m05s -1.7mag az:167.3° SSE h:11. Time uncertainty of about 31 seconds

22:17:27.24 Declination

ISS R.A.=11:15:18 Dec=+38:55:08 (J2000) -4.0 mag
11.04.2019 11:46:30.0



NAKED-EYE OBSERVATION

衛星 (Iridium satellites)

Thursday 11 April 2019

Time (24-hour clock)	Object (Link)	Event
21h47m59s	COSMO-SkyMed 2	Flare from SAR-Panel Magnitude=-2.5mag Azimuth= 74.4° ENE altitude= 69.9° in constellation Vulpecula Flare angle=0.39° Flare center line, closest point →MapIt: Longitude=114.105°E Latitude=+22.281° (WGS84) Distance=4.8 km Azimuth=257.0° WSW Peak Magnitude=-2.6mag Satellite above: longitude=116.1°E latitude=+22.8° height above Earth=624.4 km distance to satellite=661.1 km Altitude of Sun=-5.1° This is an experimental flare prediction. Brightness estimate may be unreliable. Please report a successful observation (Object/site coordinates/date/measured time/accuracy/magnitude).

Friday 12 April 2019

Time (24-hour clock)	Object (Link)	Event
21h47m59s	COSMO-SkyMed 3	Flare from SAR-Panel Magnitude=-2.5mag Azimuth= 73.5° ENE altitude= 69.8° in constellation Vulpecula Flare angle=0.60° Flare center line, closest point →MapIt: Longitude=114.080°E Latitude=+22.276° (WGS84) Distance=7.3 km Azimuth=257.0° WSW Peak Magnitude=-2.6mag Satellite above: longitude=116.1°E latitude=+22.8° height above Earth=624.4 km distance to satellite=661.3 km Altitude of Sun=-4.9° This is an experimental flare prediction. Brightness estimate may be unreliable. Please report a successful observation (Object/site coordinates/date/measured time/accuracy/magnitude).

Saturday 13 April 2019

Time (24-hour clock)	Object (Link)	Event
21h36m43s	COSMO-SkyMed 1	Flare from unknown Mirror Magnitude= 0.8mag Azimuth= 37.7° NE altitude= 39.1° in constellation Lacerta Flare angle=3.21° Flare center line, closest point →MapIt: Longitude=114.794°E Latitude=+22.444° (WGS84) Distance=68.4 km Azimuth= 75.5° ENE Peak Magnitude=-1.5mag Satellite above: longitude=118.3°E latitude=+26.7° height above Earth=624.8 km distance to satellite=932.3 km Altitude of Sun=-7.3° This is an experimental flare prediction. Brightness estimate may be unreliable. Please report a successful observation (Object/site coordinates/date/measured time/accuracy/magnitude).

THROUGH TELESCOPE

雙筒望遠鏡

credit: leisurelyscientist.com

INTRODUCTION

觀星介紹（3）

雙筒望遠鏡很適合觀星初學者去使用。可先跟同學教學使用雙筒望遠鏡的技巧。購買時要留意是否有濾鏡。可用指星筆輔助同學找到觀察目標。

THROUGH TELESCOPE

天文望遠鏡

深空天體

行星

月球

INTRODUCTION

觀星介紹（4）

行星比較容易透過望遠鏡觀察，可留意最近有沒有行星出現。不建議在滿月時觀察月球，因為不容易看到月球上的坑紋。觀察月球時最好先安置濾鏡，以免眼睛受到傷害。

TALK/BOOTH

REMIND

溫馨提示

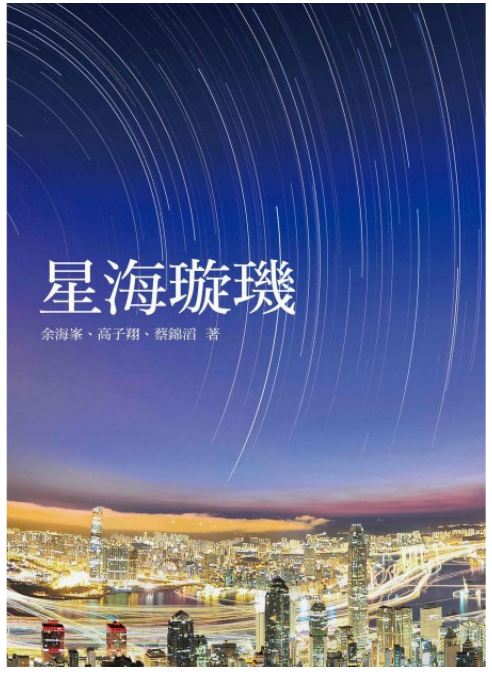
論座的內容自行決定，可多留意同學有興趣的課題。
內容不要過多，同學未必能消化。

TALK/BOOTH

資料來源……

WIKIPEDIA
The Free Encyclopedia

NASA



REMIND

溫馨提示

不要直接抄襲。

SHARING

PREPARED BY RAVEN LAU

DATE: MARCH 21, 2019