



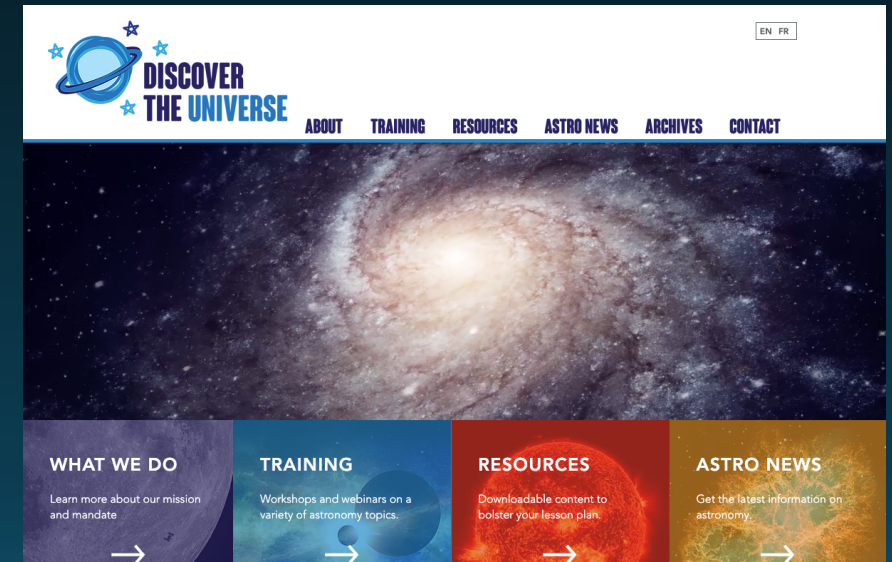
WORKSHOP FOR TEACHERS LEVEL 2

DISCOVER THE UNIVERSE

www.discovertheuniverse.ca

Astronomy training program for teachers and informal educators

- Free online training
- Resources and news



ASTRO AT HOME

<https://www.discovertheuniverse.ca/astro-home>

Astro mini-course for kids aged 8-12 (while schools are closed...)

Every weekday at 2pm, eastern time (Montreal time)



WORKSHOP FOR TEACHERS

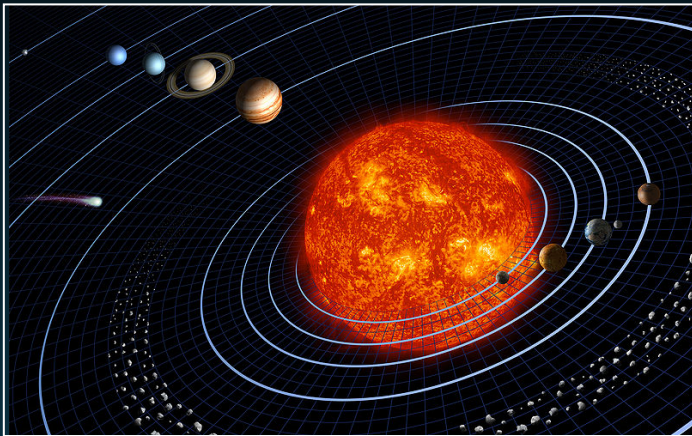
LEVEL 2

Every week, you will have access to:

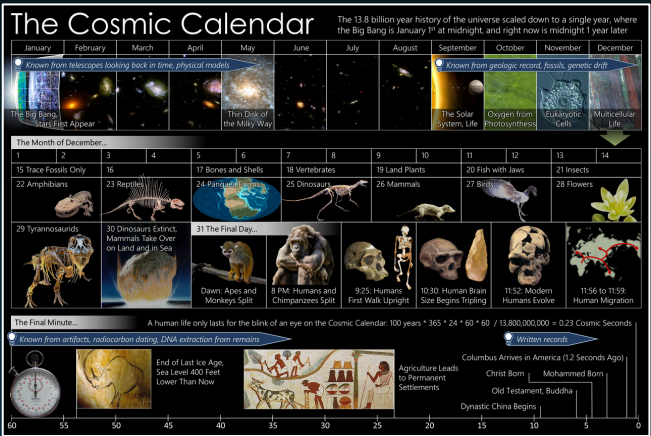
- new series of videos where we will teach you some concepts and show resources;
- activity ideas to try with your students;
- resources to learn more;
- virtual office hours (on Zoom) where I will answer your questions: Thursdays at 3pm, EDT - Montreal time;

WORKSHOP FOR TEACHERS

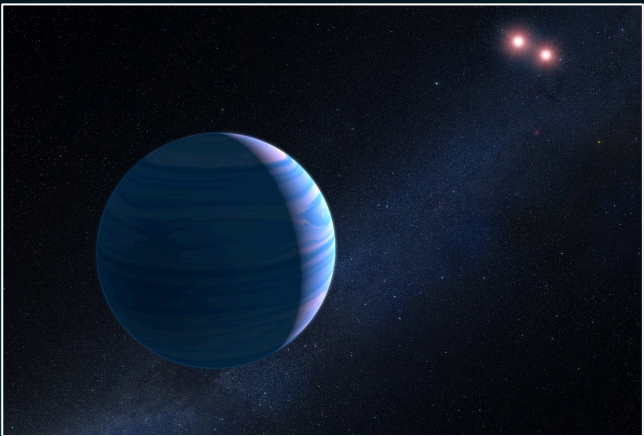
LEVEL 2



Week 1



Week 2



Week 3

**DISCOVER
THE UNIVERSE**



**À LA DÉCOUVERTE
DE L'UNIVERS**

Contact Us!

Contactez-nous!

www.discovertheuniverse.ca | www.decouvertedelunivers.ca

info@discovertheuniverse.ca | info@decouvertedelunivers.ca



Discover the Universe
À la découverte de l'univers



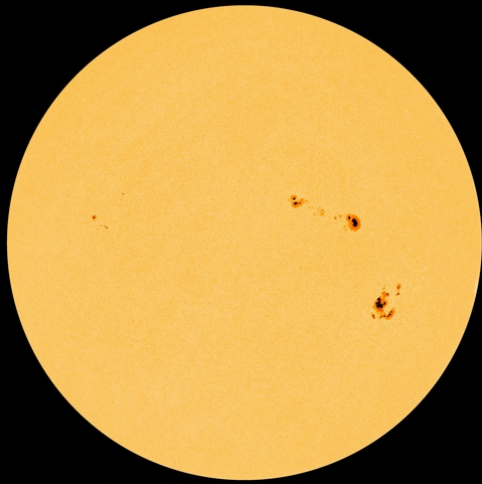
DU_astronomy
DU_astronomie



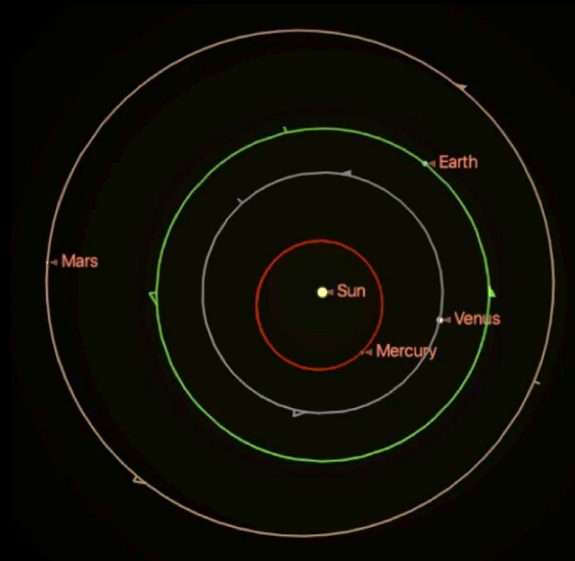
facebook.com/discovertheuniverse
facebook.com/decouvertedelunivers

WEEK 1

OUR SOLAR SYSTEM



Sun & Solar Activity



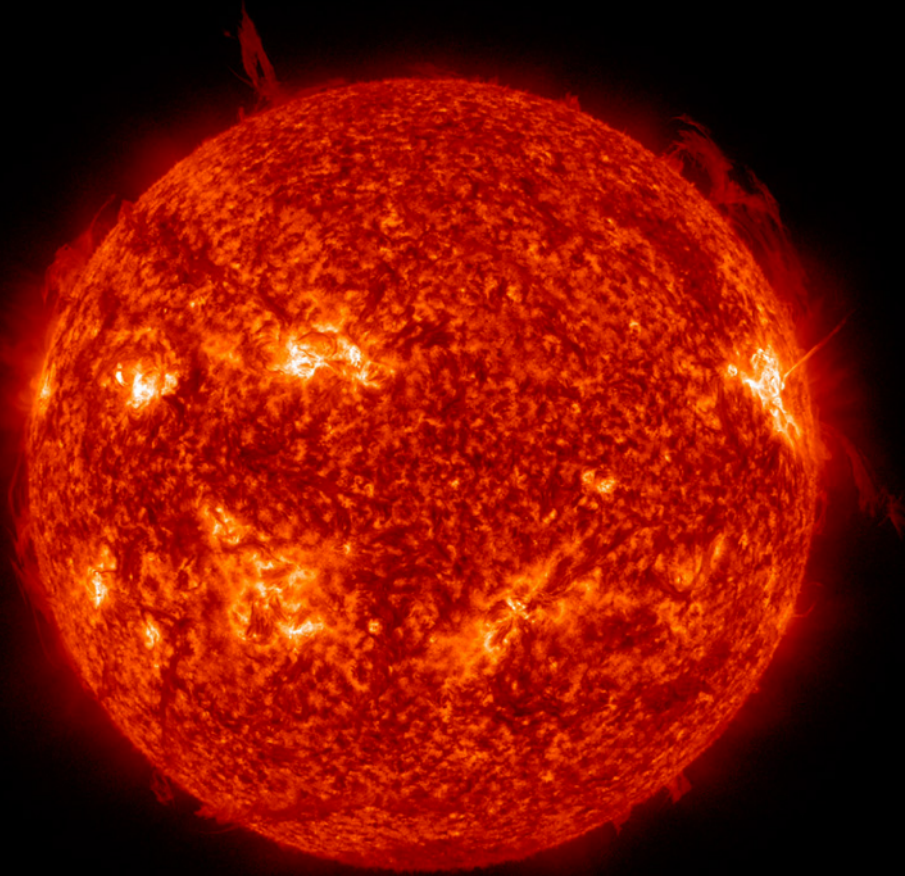
Gravity & Orbits



Impact Cratering

SUN & SOLAR ACTIVITY

THE SUN, OUR STAR



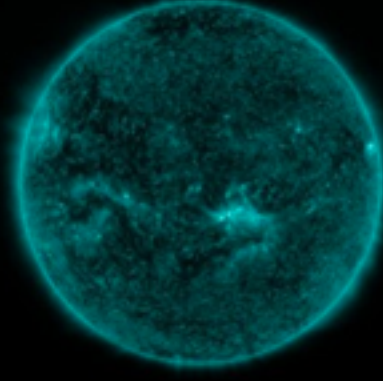
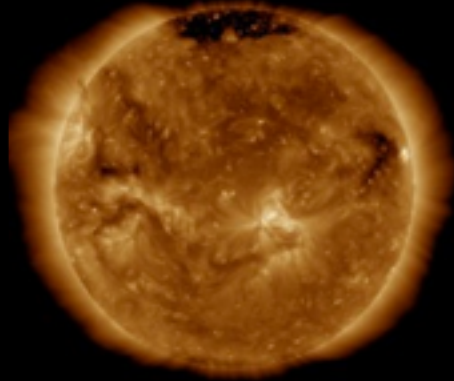
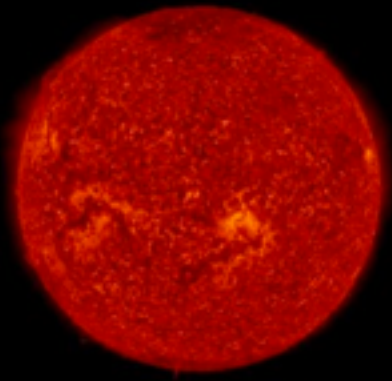
The Sun is a relatively average star: not the biggest, not the smallest.

Surface temperature: 5500 °C

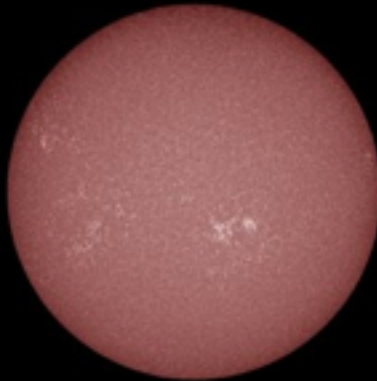
Core temperature: 15,000,000 °C

The heat comes from the nuclear fusion in its core: hydrogen atoms are combining to create helium atoms. This emits a lot of energy ($E=mc^2$).

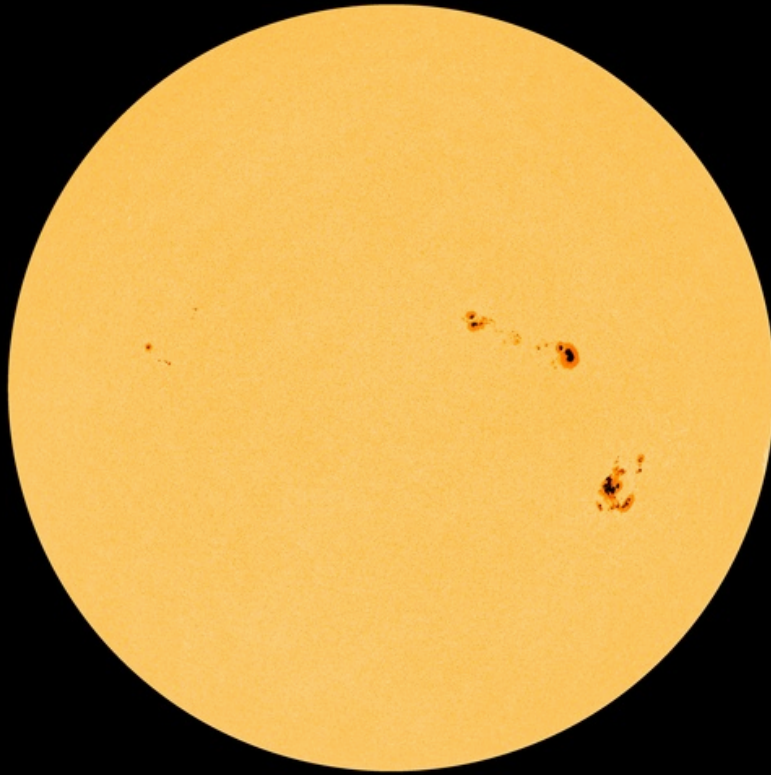
WHAT DOES THE SURFACE OF THE SUN LOOK LIKE?



What is the real colour of the Sun?



SUNSPOTS

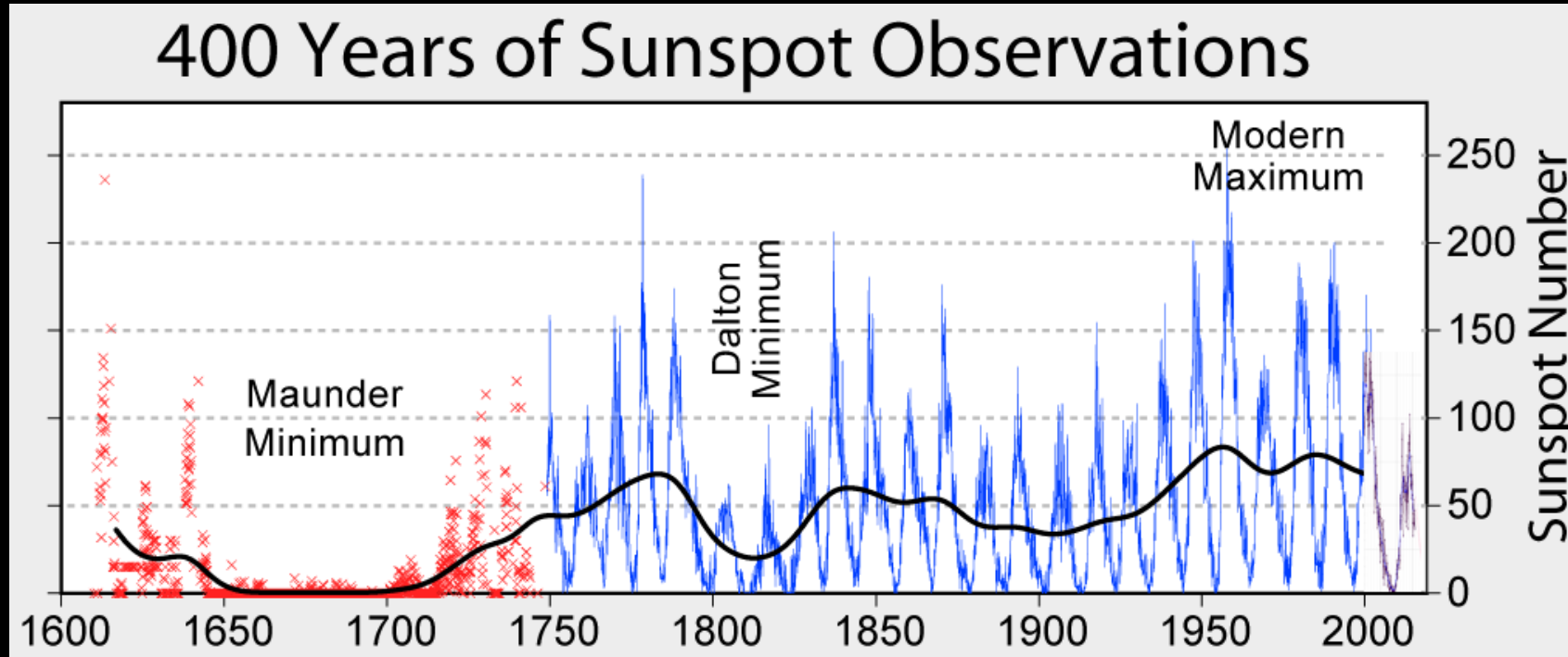


30/988 Quick-Look Continuum 20170906_130000

In visible light, we can see sunspots.

The number of sunspots varies with time.

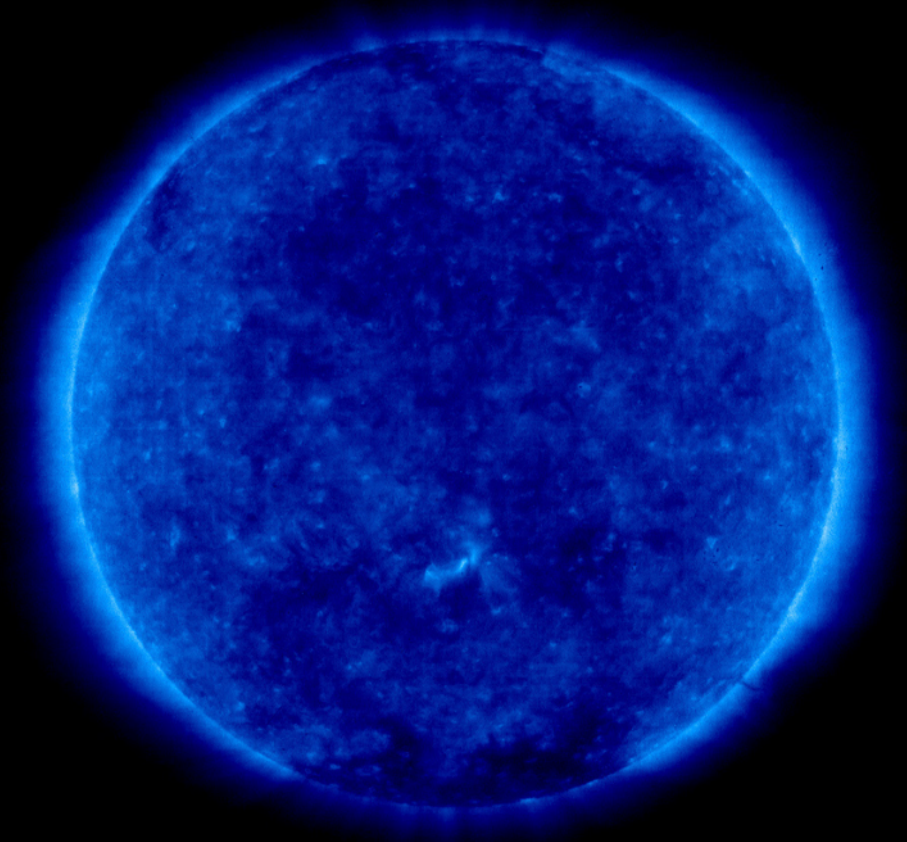
SOLAR CYCLE



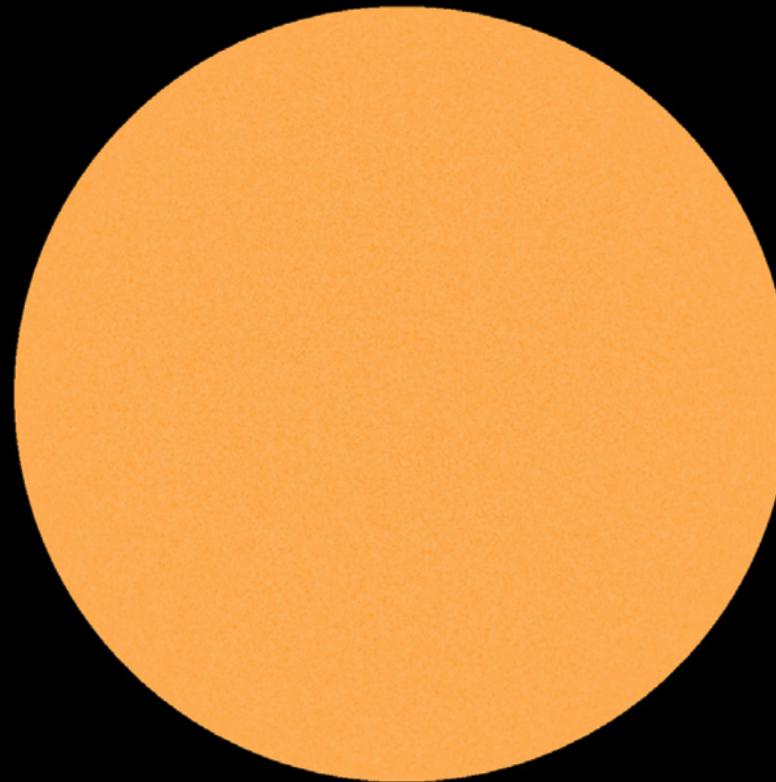
Solar activity varies with a 11-year cycle.

SOLAR MINIMUM

(inactive period)



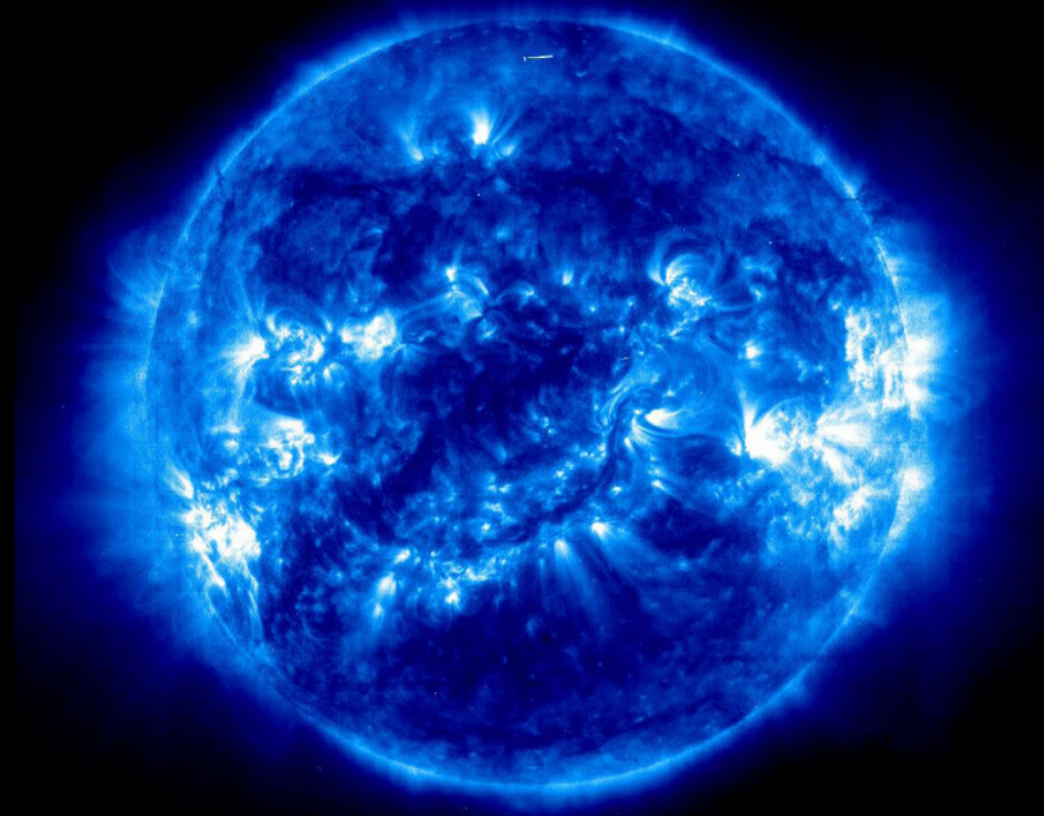
ultraviolet



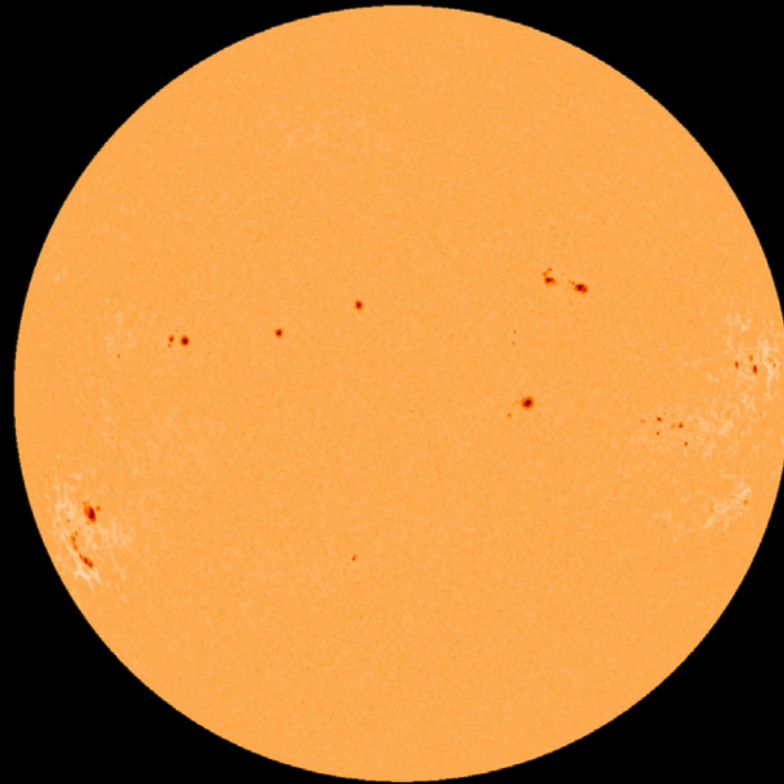
visible light

SOLAR MAXIMUM

(active period)



ultraviolet

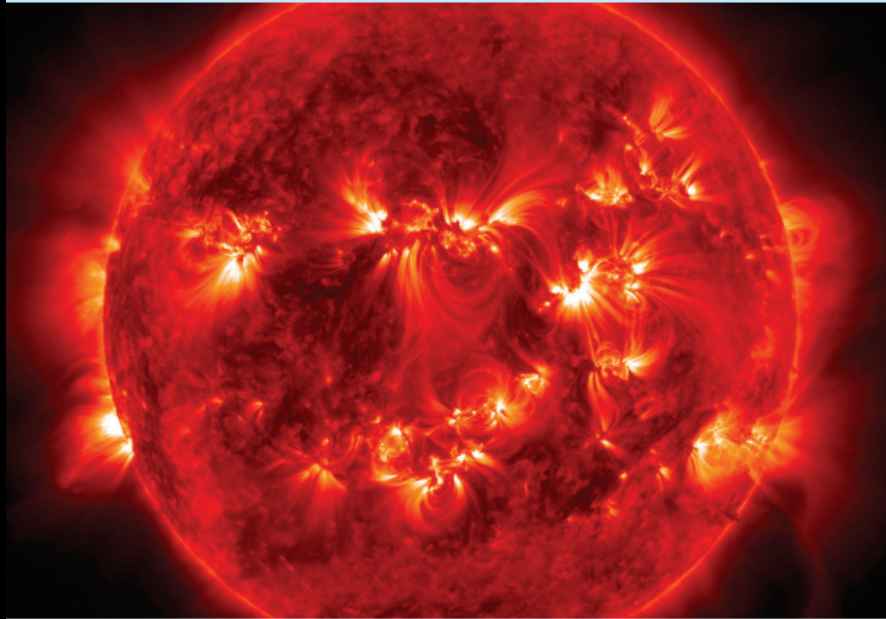


visible light



THE SOLAR CYCLE

Inquiry-based activity guide for
secondary school teachers

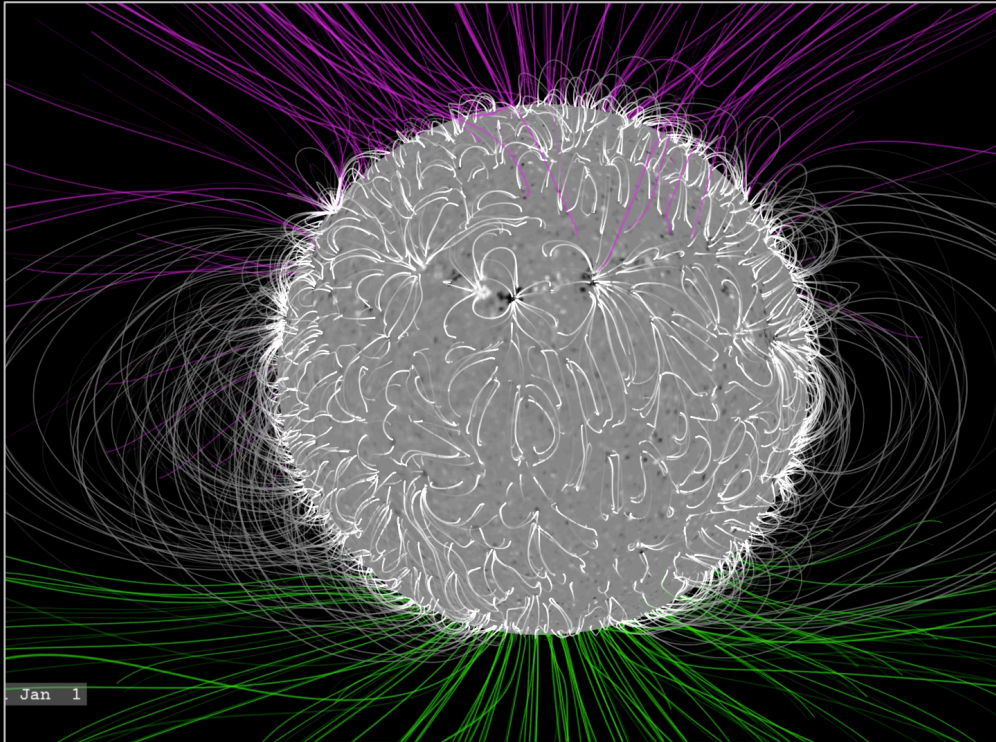


DUNLAP INSTITUTE
for ASTRONOMY & ASTROPHYSICS

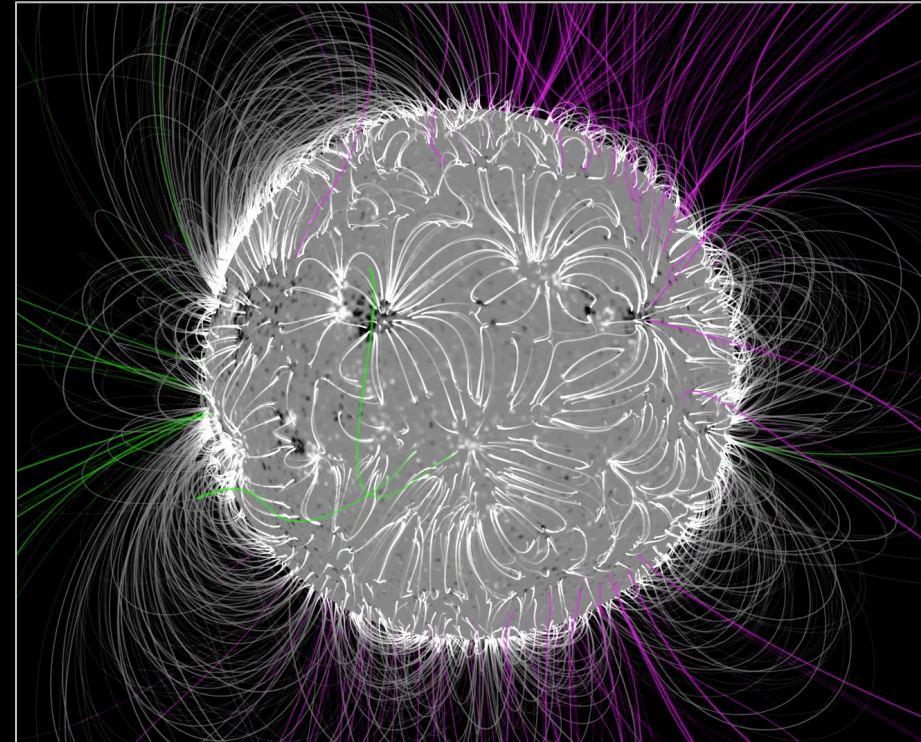
Inquiry-based activity guide for secondary school teachers to help students investigate the solar cycle through real satellite images of the Sun.

<https://www.discovertheuniverse.ca/resources>

MAGNETIC FIELD OF THE SUN



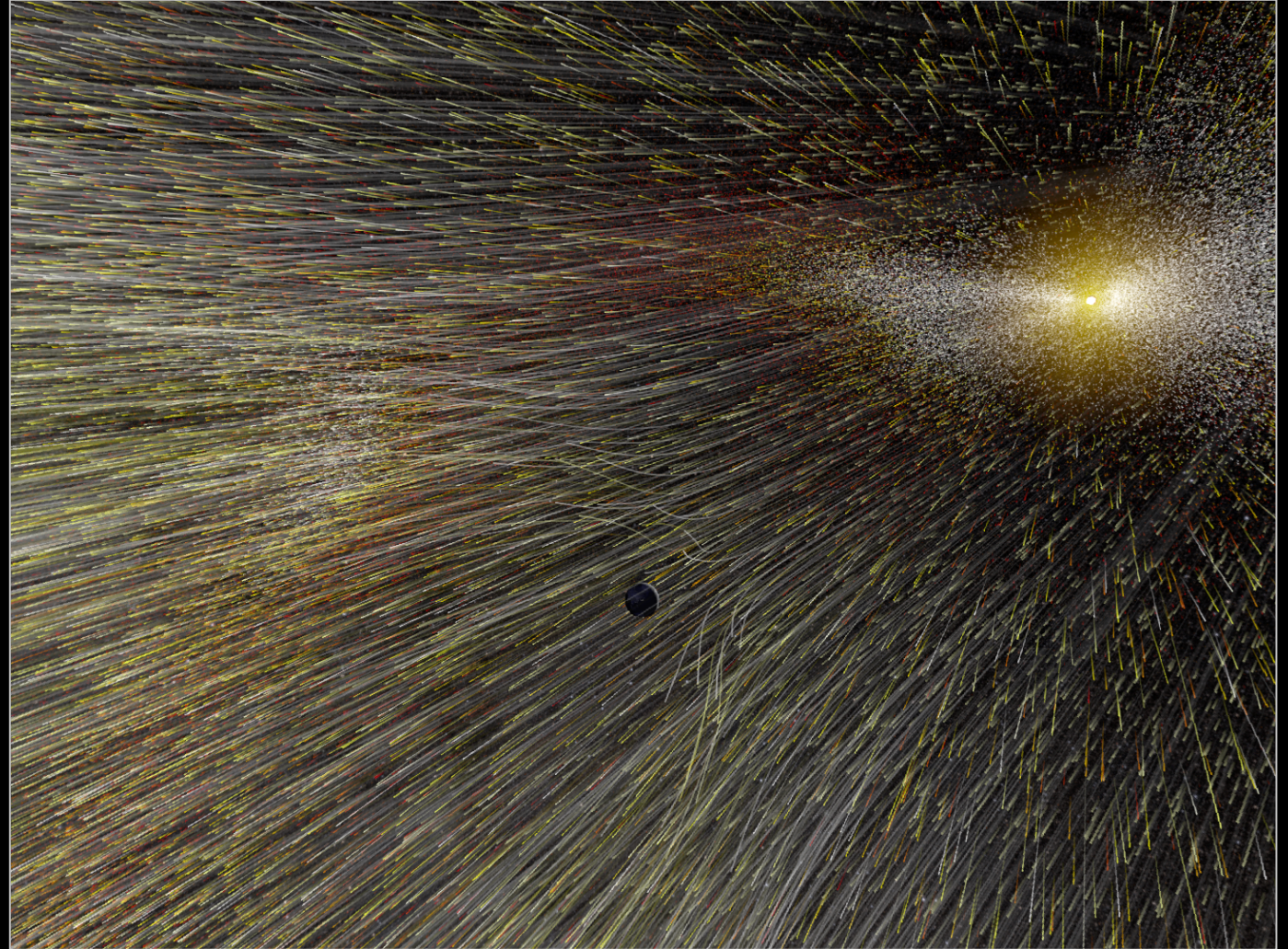
"Simple" magnetic field during solar minimum



Tangled magnetic field during solar maximum

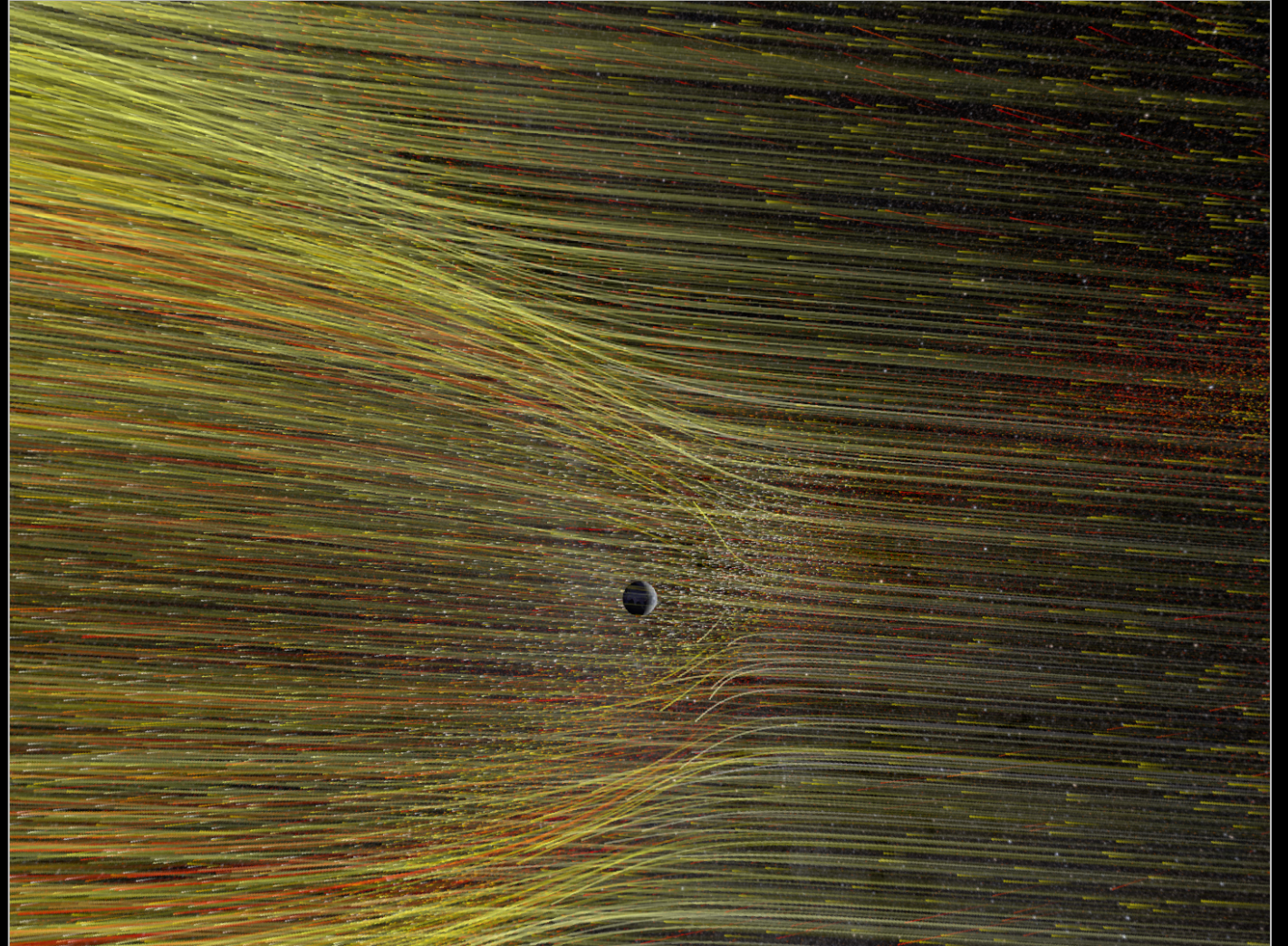
SOLAR WIND

The Sun emits a constant stream of particles. The solar wind becomes more intense when the Sun is more active (solar maximum).



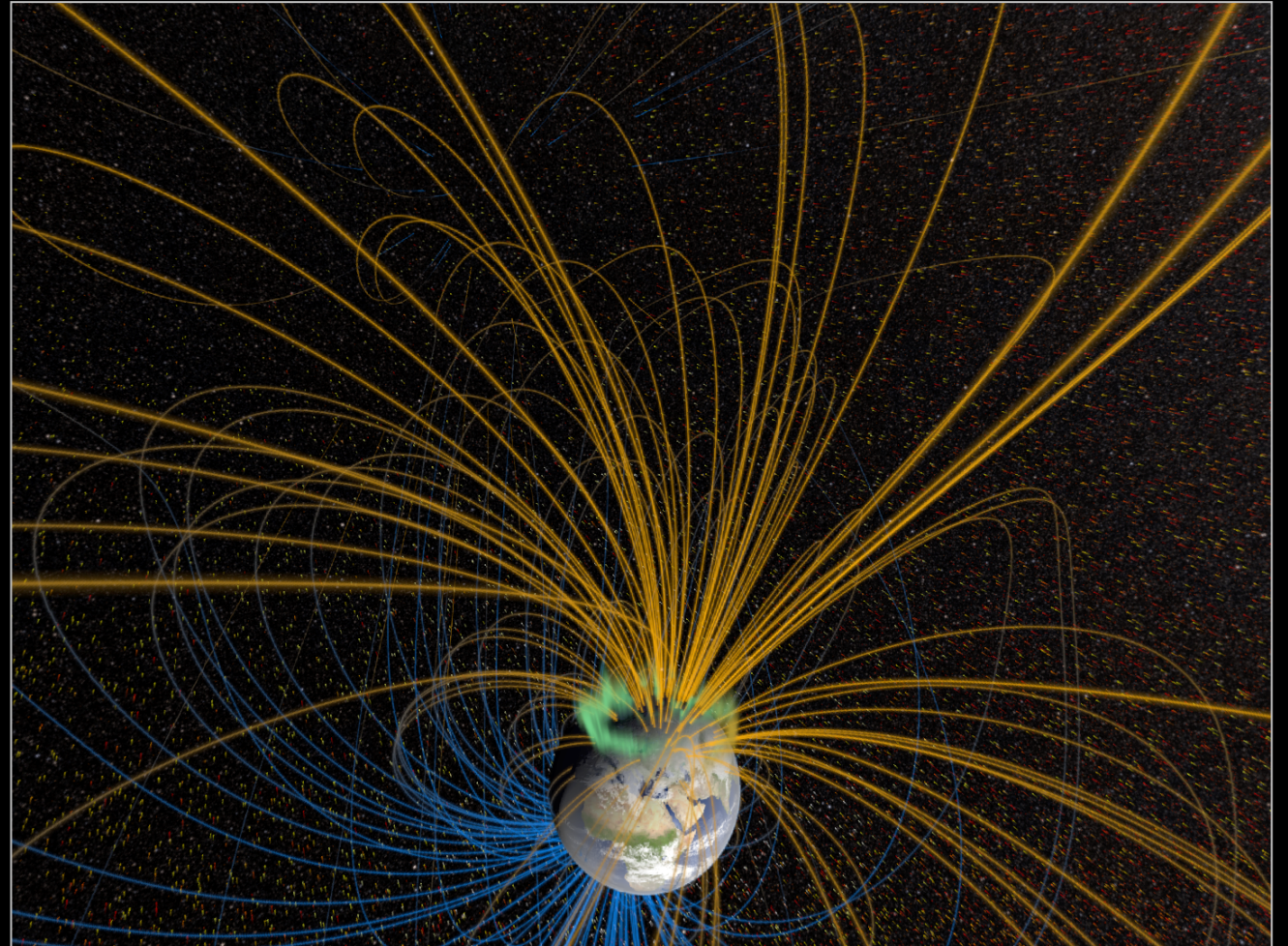
SOLAR WIND

The Earth's magnetic field acts like a shield and protects us from the solar wind.



NORTHERN LIGHTS

At the poles, the solar wind can reach lower in the atmosphere and it makes the gases in our atmosphere glow, creating auroras (borealis and australis) or northern/southern lights.



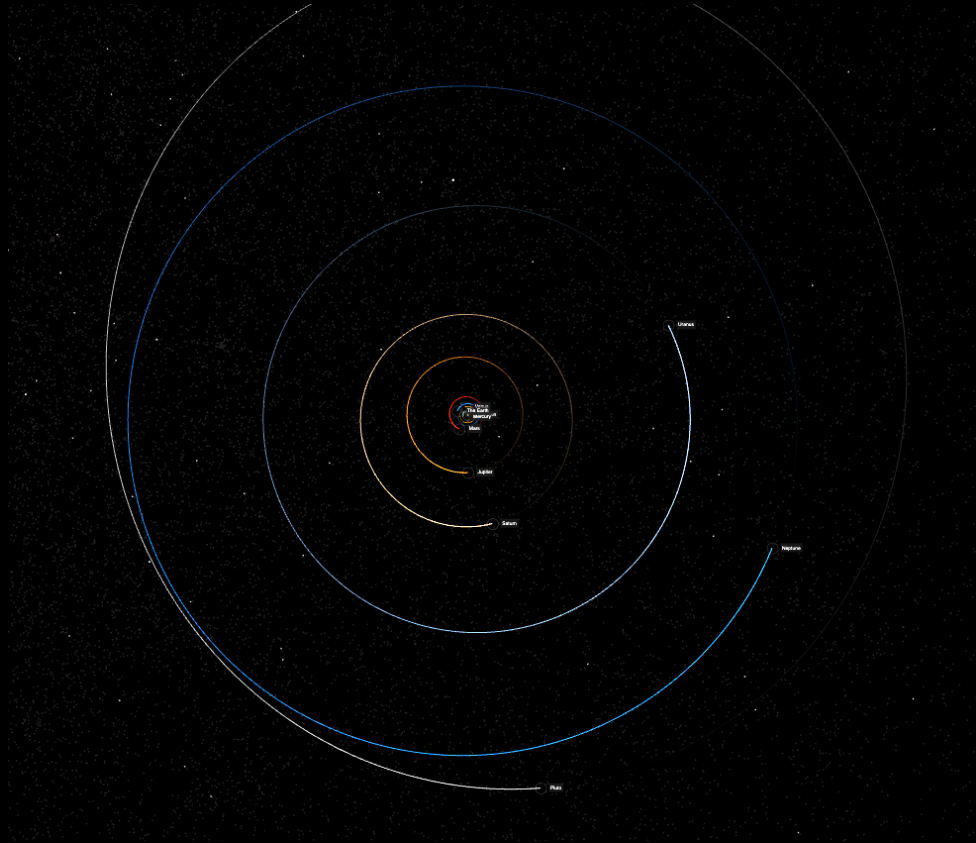


Credit: U.S. Air Force

https://commons.wikimedia.org/wiki/File:Polarlicht_2.jpg

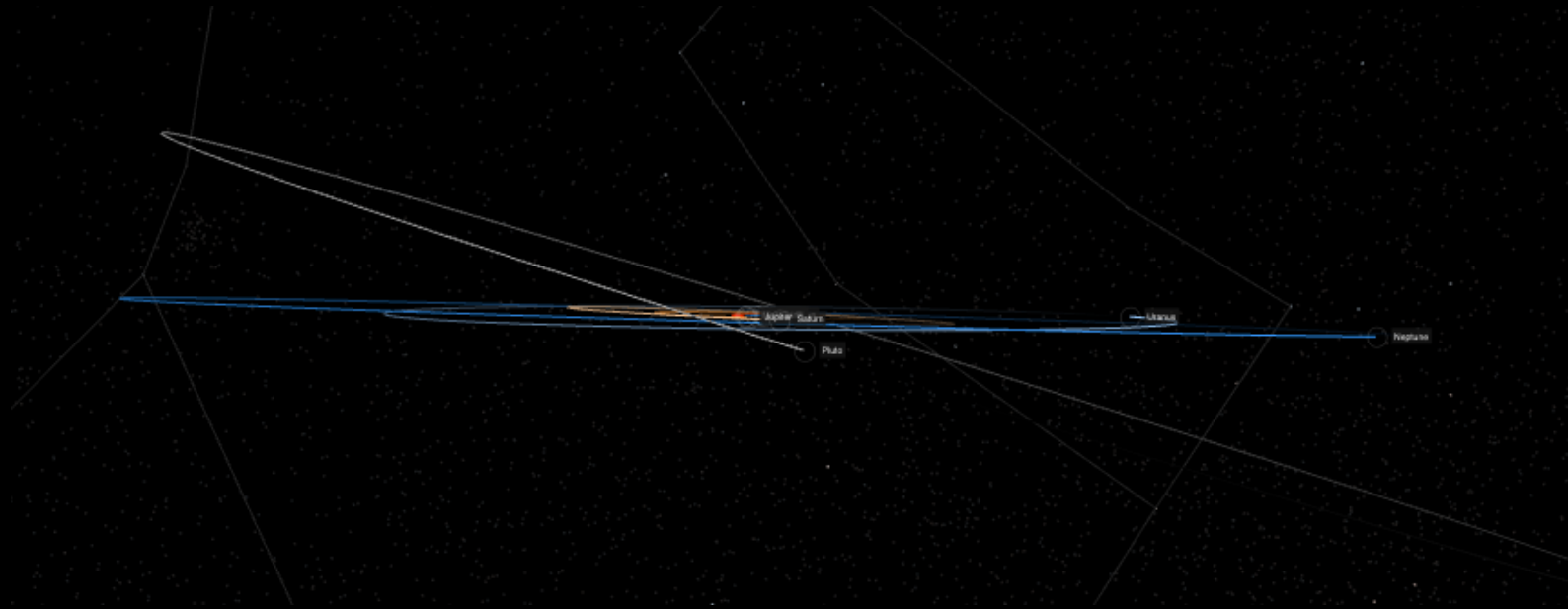
GRAVITY AND ORBITS

ORBITS OF THE PLANETS



<http://mgvez.github.io/jsorrery/>

ECLIPTIC

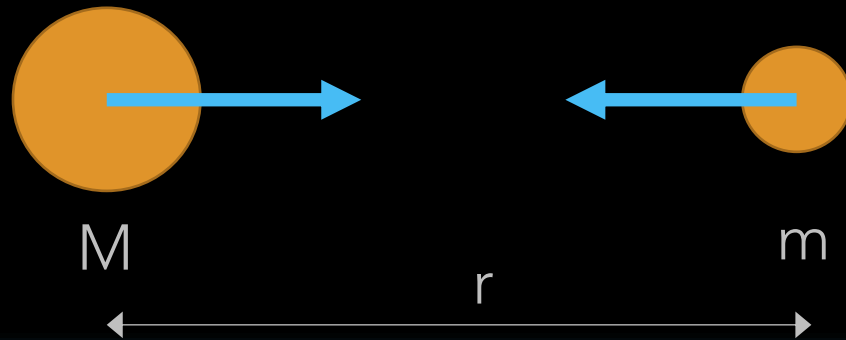


The ecliptic is the plane created by the orbit of the Earth around the Sun. The other planets also orbit in the same plane, within a few degrees (max 7° for Mercury).

GRAVITY

The gravitational force is what holds objects in orbit around the Sun.

This force depends on the masses of the objects and the distance between them. The force affects both objects.



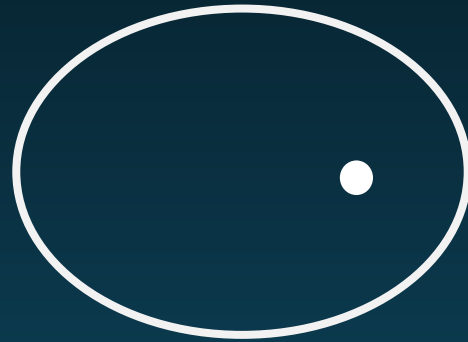
$$F = G \frac{Mm}{r^2}$$

G: gravitational constant

ORBITS

Orbits are ellipses and not perfect circles.

The Sun is at one of the foci of the ellipse.



ORBITS

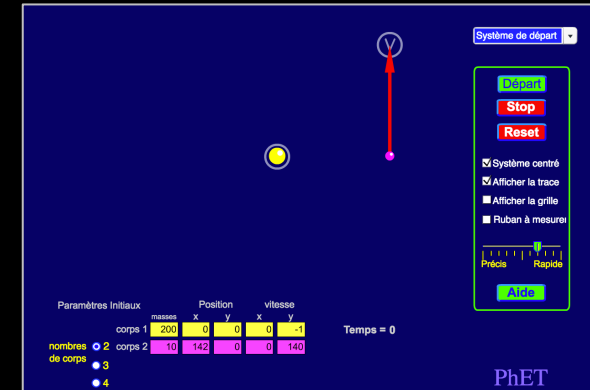
The closer an object is to the Sun, the faster it moves.

- An object closer to the Sun (e.g. Mercury) moves faster than an object further away (e.g. Neptune).
- The speed of an object varies during its orbit since the distance to the Sun varies (ellipse). For example, the Earth moves faster when it is closer to the Sun.

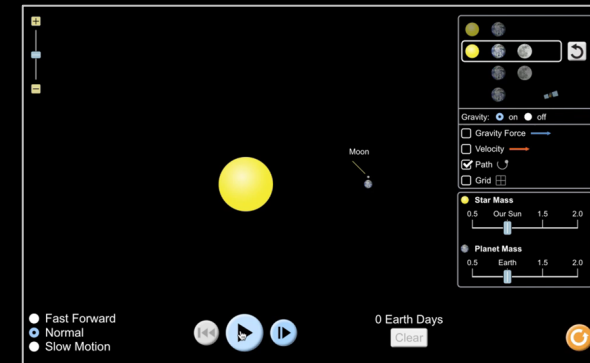
PLAYING WITH ORBITS

PhET Simulations

https://phet.colorado.edu/sims/my-solar-system/my-solar-system_en.html



https://phet.colorado.edu/sims/html/gravity-and-orbits/latest/gravity-and-orbits_en.html

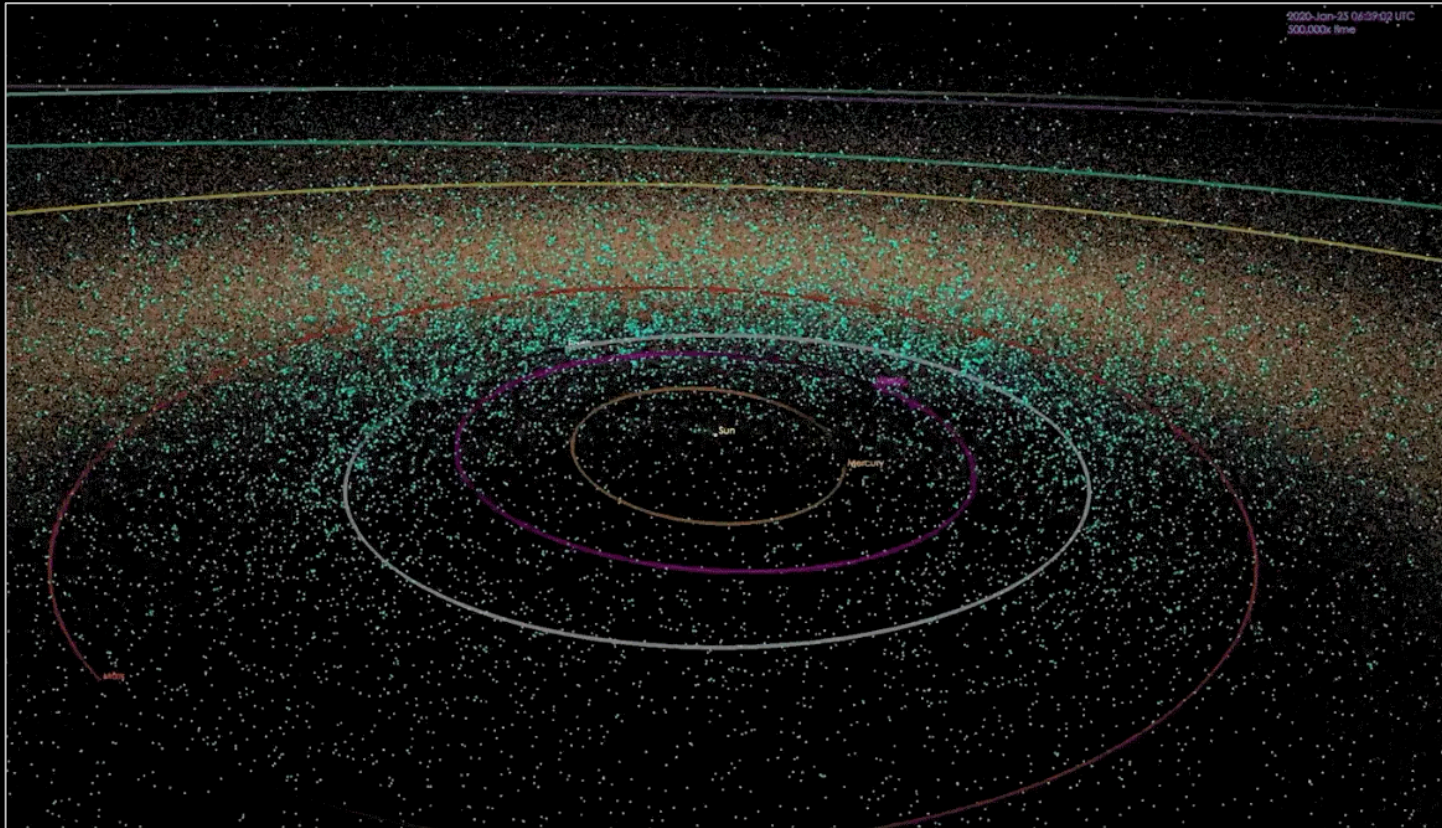


IMPACT CRATERING

A FEW DEFINITIONS...

- ★ **Asteroid:** Small body orbiting the Sun, mostly made of rock and with an irregular shape (~ 10 m up to 100s of km) .
- ★ **Meteoroid:** Very small rock in orbit around the Sun.
- ★ **Meteor:** Streak of light caused by a space rock falling into the Earth's atmosphere (shooting star)
- ★ **Bolide/fireball:** Very bright meteor
- ★ **Meteorite:** Space rock which falls into the atmosphere and makes it to the ground.

POSITION OF ASTEROIDS



Yes, there is a risk of impact, but it's very small (the size of the dots isn't to scale here...)

IMPACT

Kinetic Energy



Light, sound, heat...

Velocity \approx 15-30 km/s

Lots of energy!

$$E = \frac{1}{2}mv^2$$

If impact: crater will be 10s x larger than impactor

ABOUT 200 KNOWN CRATERS ON EARTH



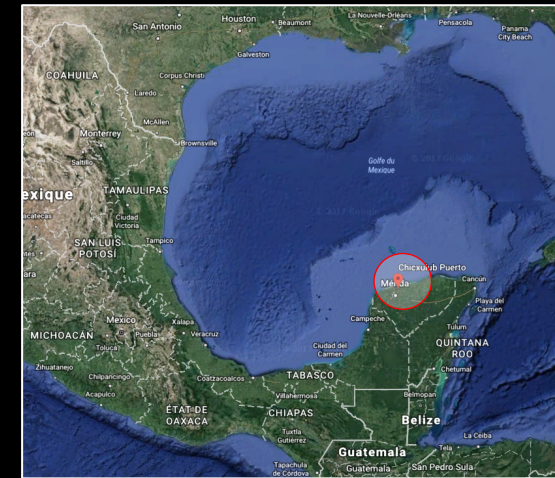
FAMOUS CRATERS



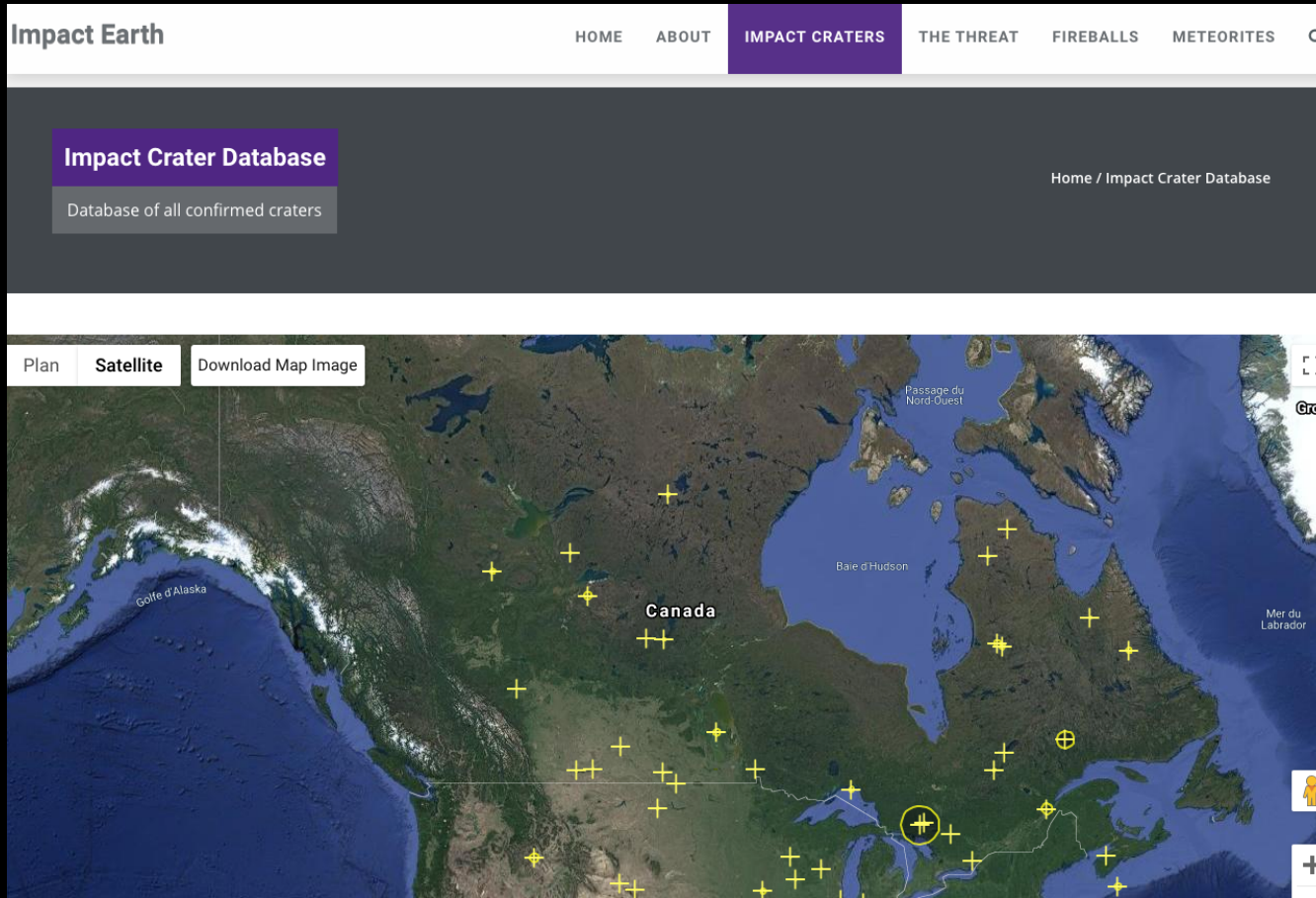
Meteor Crater, Arizona



Manicouagan Crater,
Quebec

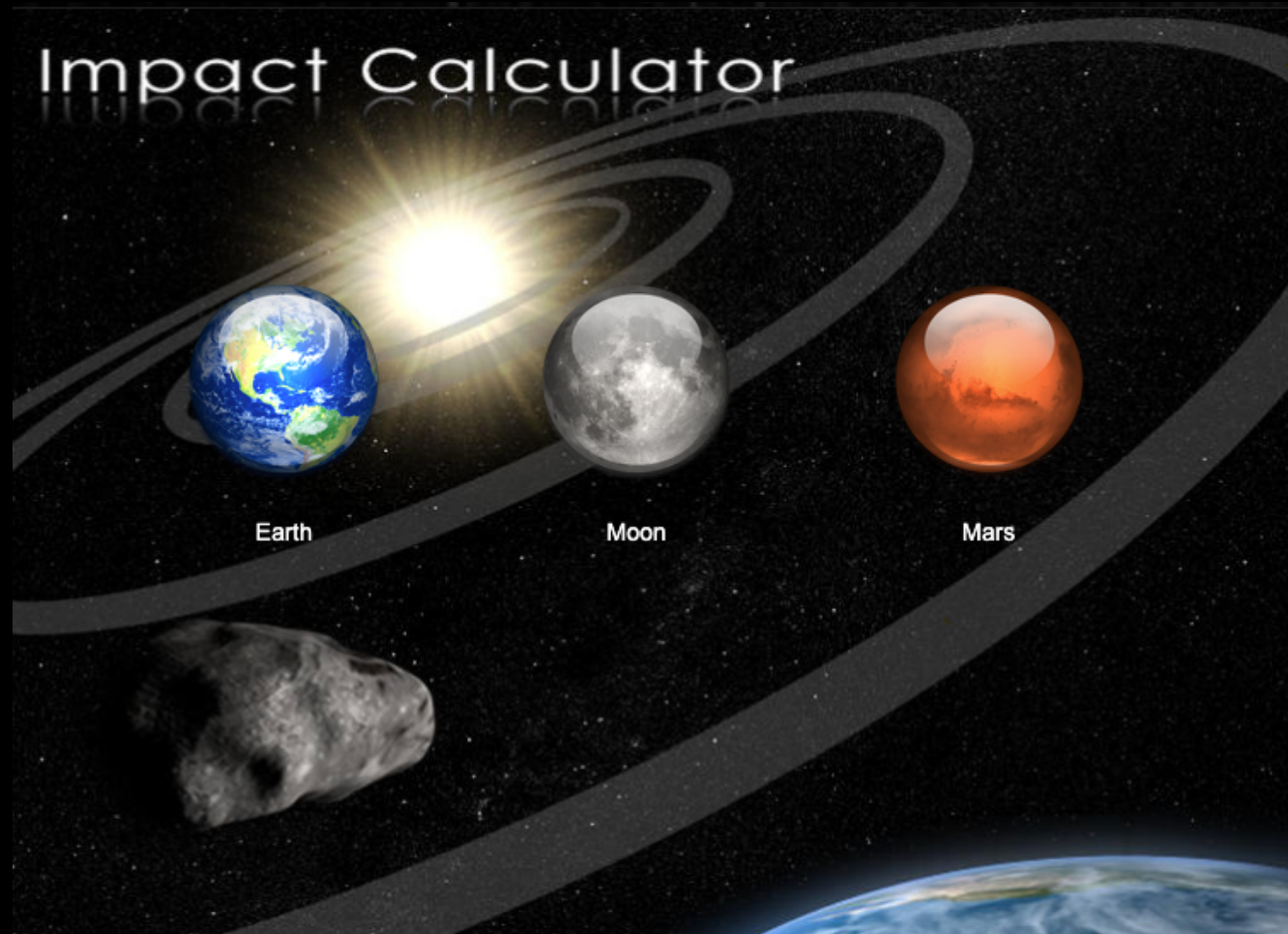


Chicxulub, Mexico



<https://impact.uwo.ca/map/>

Interactive map & activities
(under About)



<http://simulator.down2earth.eu>

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