

'Escape the Sun' Game

Version
1.0

Date

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Introduction

This document discusses how to play the *Escape the Sun* game, and gives some basic facts about the underlying science. The science is given as a guide to the possible discussion that could be had around the game. The depth of the content can of course be tailored to the audience.

Background

Radiation is generated as a by-product of the nuclear fusion process that take place in the core of the Sun, releasing energy from Hydrogen in the form of photons (gamma rays).

The journey the photon takes from the core to the surface is known as a random walk – especially in interior layer surrounding the core, known as the radiative zone. The photons essentially collide with the atoms inside the Sun and are reflected in random directions. It takes the photons approximately a hundred thousand years to reach the Sun's surface, where they can then travel almost unhindered through the Sun's atmosphere and space – reaching Earth in just 8 minutes and 20 seconds.

The *Escape the Sun* game mimics the random movement of the photon in the Sun's interior, giving the player an idea about how energy is transported by radiation.

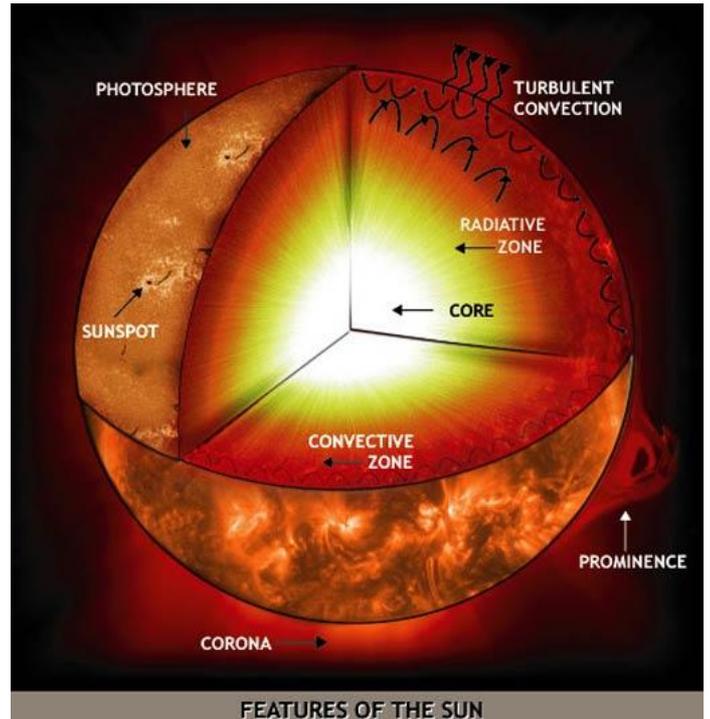


Figure 1 Courtesy: Berkeley - SSL

The photons lose energy with each collision they make. As the energy of the photon is proportional to one over the wavelength ($1/\lambda$), then the wavelength of the photon increases as energy is lost. The photons undergo enough collisions such that significant number of them leave the Sun's surface with a wavelength in the visible part of the electromagnetic spectrum ($\lambda = 500 \text{ nm}$).

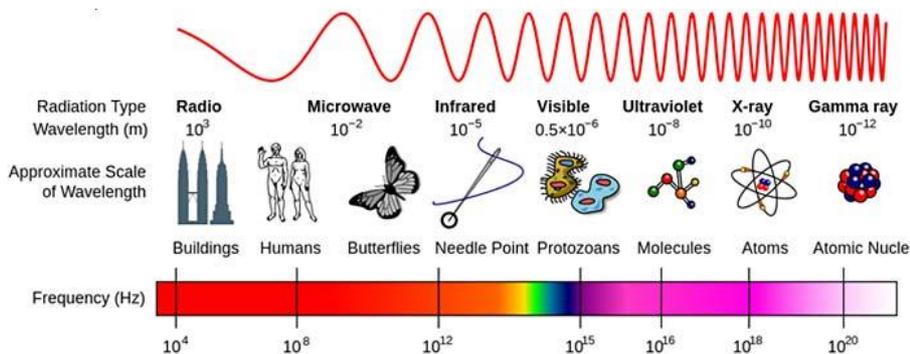


Figure 2 Electro-magnetic spectrum.
https://commons.wikimedia.org/wiki/File:EM_Spectrum_Properties_edit.svg

Required Materials

The following is required for one person to play:

- A copy of the game board
- 1 six-sided die
- A counter to represent the photon

A digital copy of the board is provided as a pdf (*Escape_the_sun_game_board.pdf*). We recommend printing the game board on A3 paper and laminating the board.

For classroom activities, we have found that it works well for students in groups of two – taking turns to role the dice. Each pair of student requires the above resource.

How to play

Aim: Get your photon to the Sun's surface. You win when you escape.

- Place the photon counter on the hexagon at the centre of the board, the Sun's core.
- Roll the dice.
- The number on the dice corresponds to the direction that the counter should be moved. The numbers around the edge of the board indicate the direction.
- The counter should only move one space on each turn.

A series of slides demonstrate the game play in the pdf - *Escape_the_sun_movements.pdf*.

Acknowledgements

This version of the photon journey game was inspired by a similar version found on the NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION Space Weather Prediction Center website (working link at time of writing: <https://www.swpc.noaa.gov/content/solar-physics-and-terrestrial-effects-curriculum-guide-teachers-grades-7-12>)

The game board was designed by Ivan del Ray Cousins & NUSTEM (Northumbria University).