

Órbita planetaria

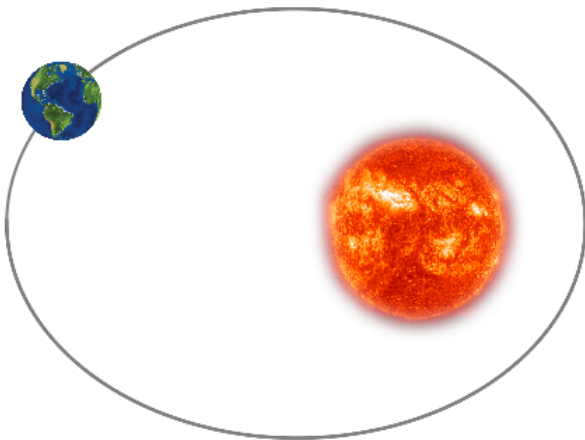
ExactasPrograma

Facultad de Ciencias Exactas y Naturales, UBA

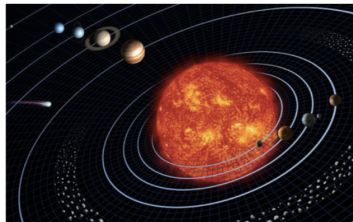
Verano 2020

Objetivo:

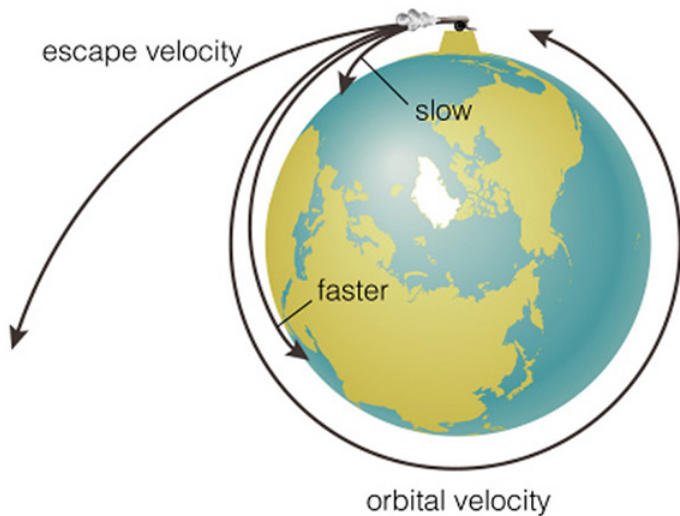
Hacer un programa que **calcule** y **grafique** la trayectoria de la Tierra alrededor del Sol



Ley de gravitación **universal**



Ley de gravitación **universal**



Ley de gravitación universal

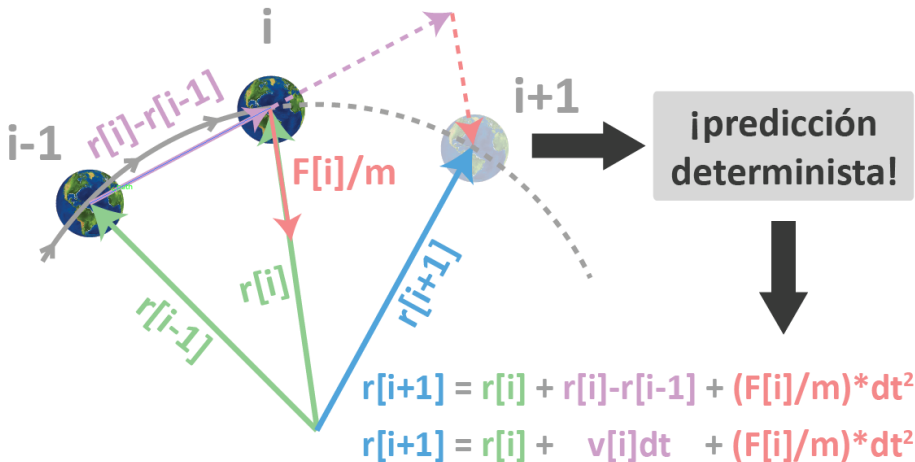
The diagram illustrates the relationship between gravitational force, distance, and acceleration in the Earth-Sun system. It is divided into two horizontal sections on a black background.

Top Section: Shows Earth on the left and the Sun on the right. A red arrow labeled F points from Earth towards the Sun, and another red arrow labeled F points from the Sun towards Earth. A green horizontal line with vertical end caps below it is labeled d , representing the distance between them. To the right of this diagram is the equation $F = G \frac{Mm}{d^2}$, where F is red, G is white, M and m are white, and d^2 is green.

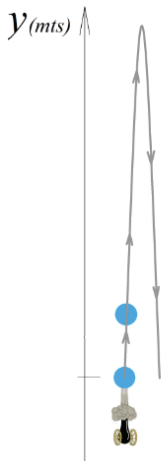
Bottom Section: Shows the same Earth and Sun. A light blue arrow labeled a points from Earth towards the Sun, and another light blue arrow labeled a points from the Sun towards Earth. To the right of this diagram is the equation $F = ma$, where F is red and ma is light blue.

Bottom Text: At the bottom of the diagram area, the text $M > 300000m \Rightarrow$ El Sol (casi) no gira is written in white.

Algoritmo de Verlet



Ejemplo sencillo: Tiro Vertical



$F=mg$ $F[i] = G \frac{M_T m}{d^2} = \underbrace{G \frac{M_T m}{R_T^2}}_g = \overset{\sim 10}{9,8 \frac{\text{mts}}{\text{seg}^2}} m$

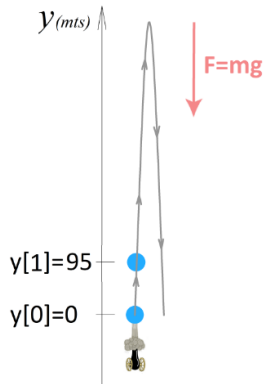
A large blue arrow points downwards from the acceleration value.

$$r[i+1] = r[i] + \underbrace{r[i] - r[i-1]} + (F[i]/m) * dt^2$$

$$r[i+1] = 2 * r[i] - r[i-1] - g * dt^2$$

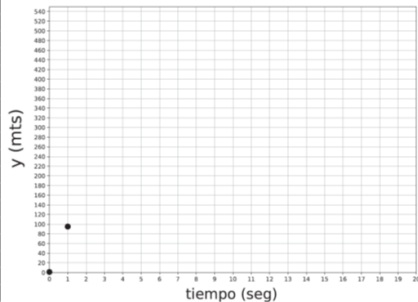
$$y[i+1] = 2 * y[i] - y[i-1] - g * dt^2$$

Juego de hoy: probemos Verlet!



Iteracion	tiempo (seg)	y (mts)
0	0	0
1	1	95
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		

$$\begin{aligned} \text{tiempo}[i + 1] &= \text{tiempo}[i] + dt \\ y[i + 1] &= 2 * y[i] - y[i - 1] - g * dt^2 \end{aligned}$$



Este tipo de cálculos se hacían...



Katherine Johnson:
matemática de la NASA



Órbita de la Tierra: ¿Cómo escribimos la **aceleración vectorial**?

