Órbita planetaria

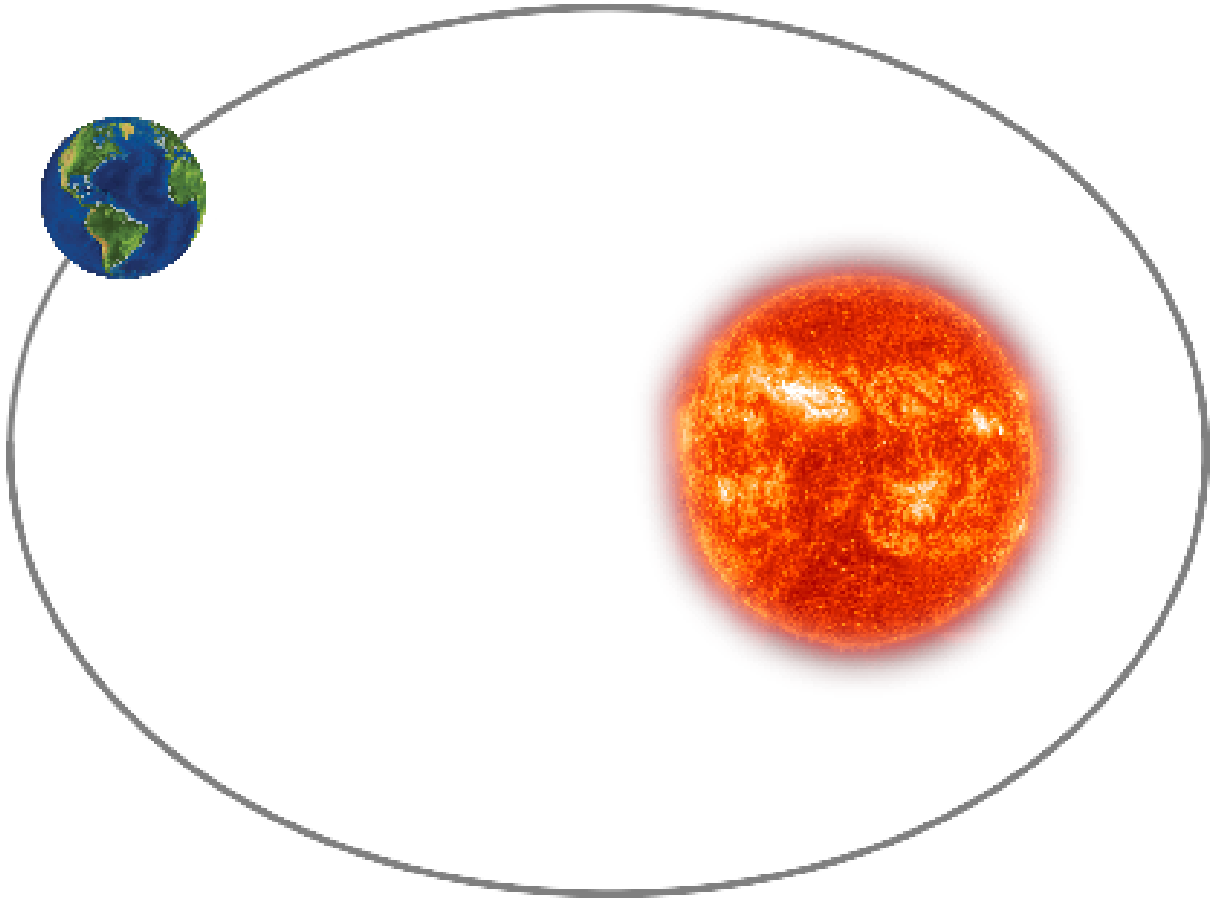
ExactasPrograma

Facultad de Ciencias Exactas y Naturales, UBA

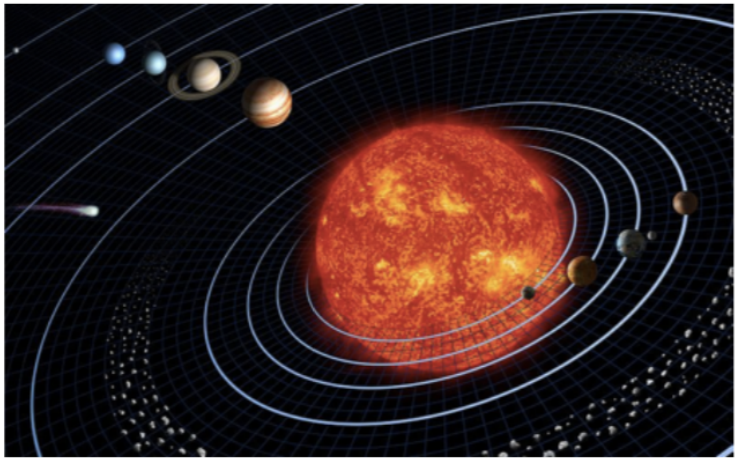
Verano 2020

Objetivo:

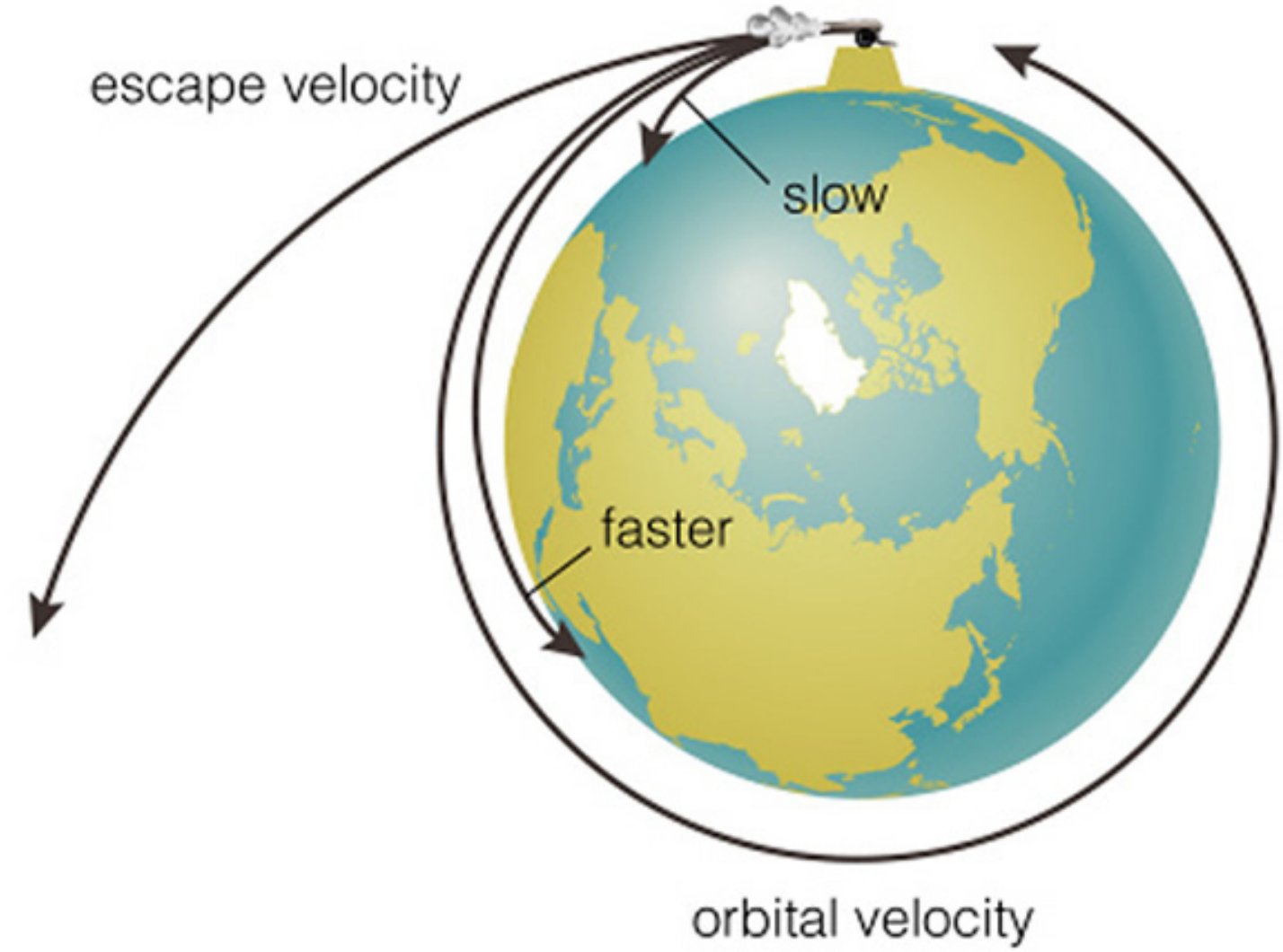
Hacer un programa que **calcule** y **grafique** la trayectoria de la Tierra alrededor del Sol



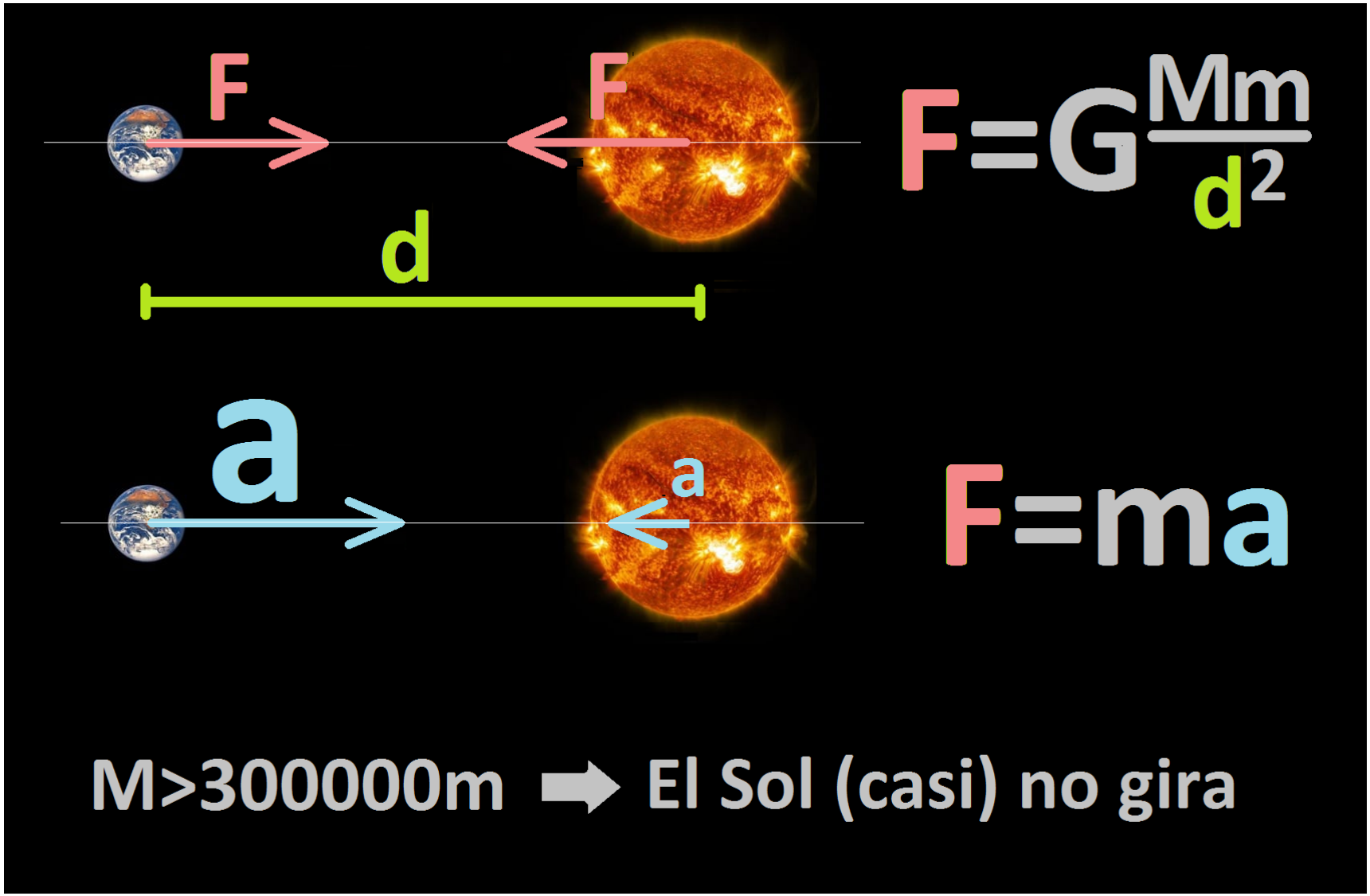
Ley de gravitación **universal**



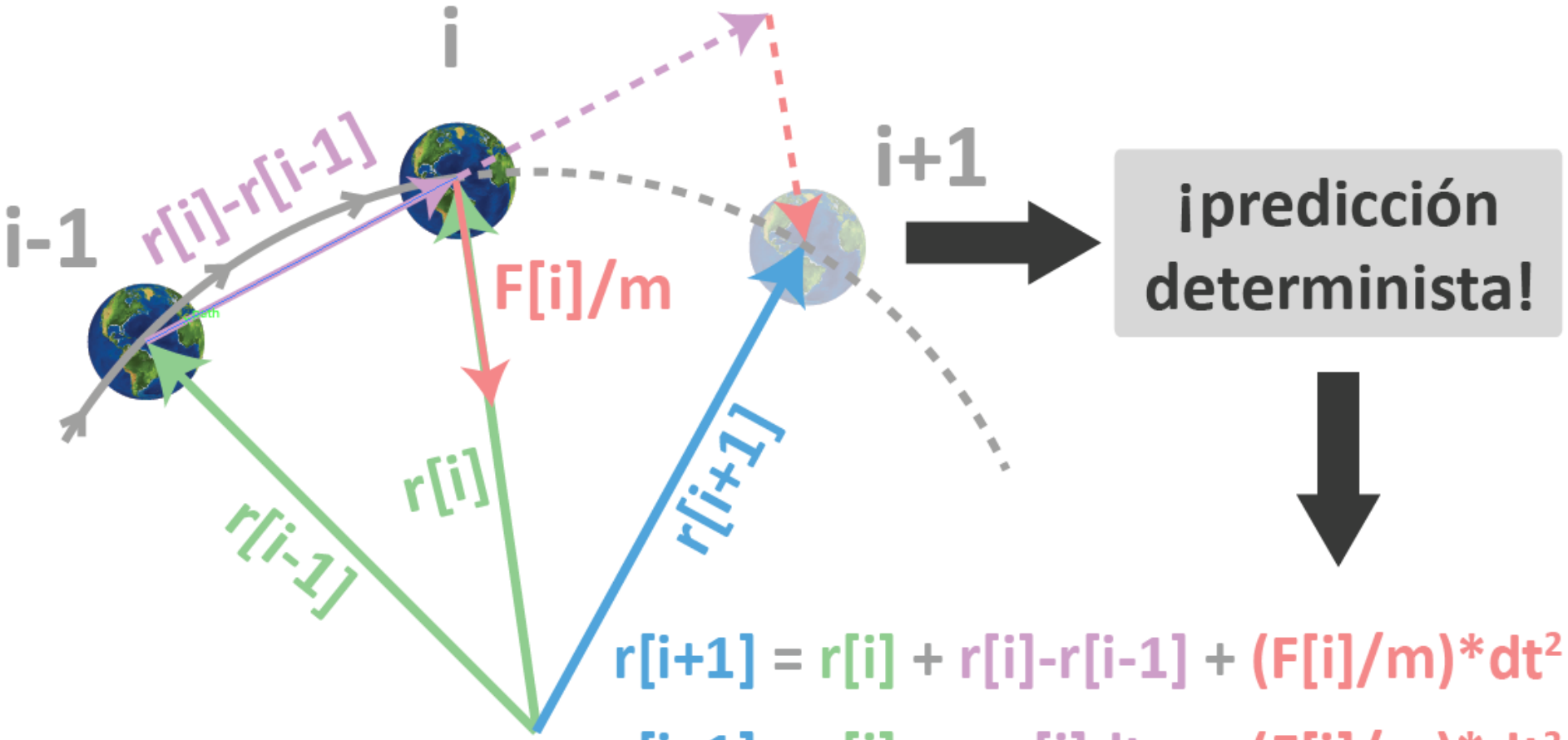
Ley de gravitación **universal**



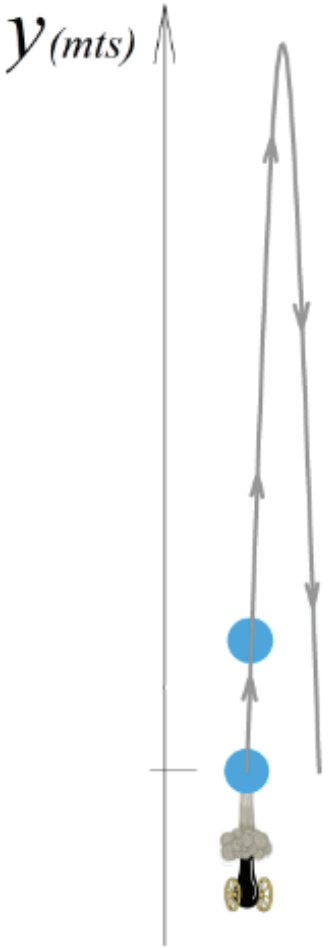
Ley de gravitación universal



Algoritmo de Verlet



Ejemplo sencillo: Tiro Vertical



F=mg

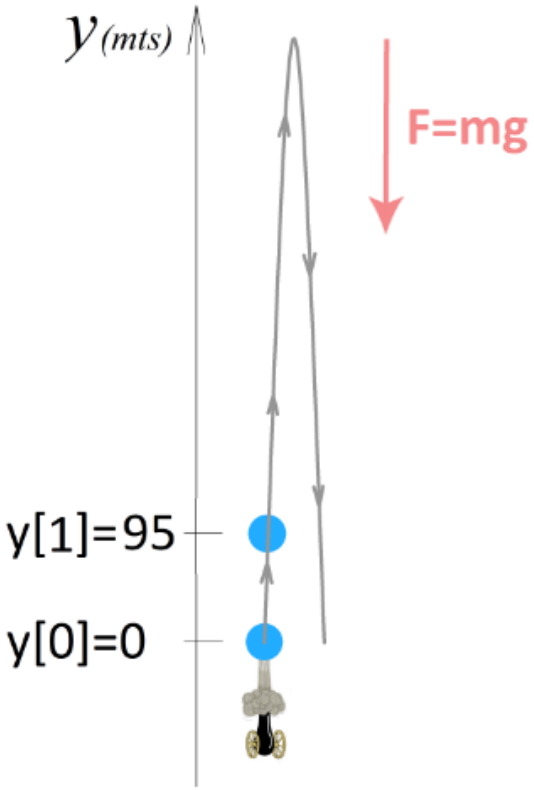
$$F[i] = G\frac{M_T m}{d^2} = \underbrace{G\frac{M_T m}{R_T^2}}_{g} = \overbrace{9{,}8\,\frac{mts}{seg}}^{\sim 10}\, m$$

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

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

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

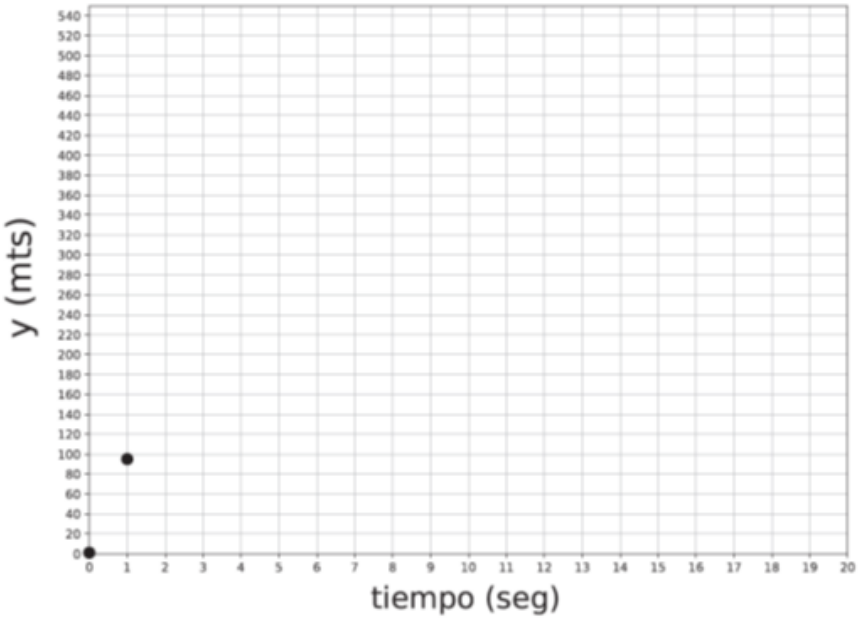
Juego de hoy: probemos Verlet!



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		

$$tiempo[i+1] = tiempo[i] + dt$$

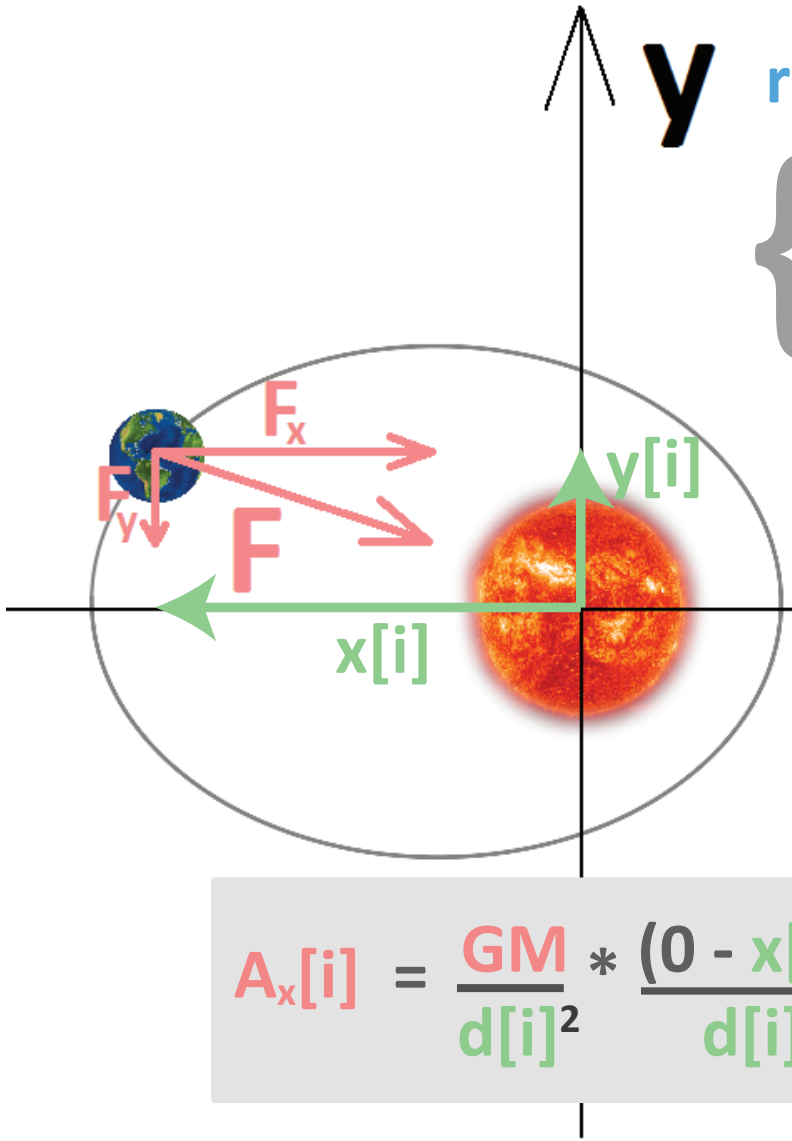
$$y[i+1] = 2 * y[i] - y[i-1] - g * dt^2$$



Este tipo de cálculos se hacían...

Katherine Johnson:
matemática de la NASA

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



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

$$\begin{cases} x[i+1] = 2*x[i] - x[i-1] + (F_x[i]/m)*dt^2 \\ y[i+1] = 2*y[i] - y[i-1] + (F_y[i]/m)*dt^2 \end{cases}$$

$$F[i]/m = \frac{GMm/d[i]^2}{m} = GM/d[i]^2$$

$$d[i]^2 = (0-x[i])^2 + (0-y[i])^2$$

$$A_x[i] = \frac{GM}{d[i]^2} * \frac{(0 - x[i])}{d[i]}$$

$$A_y[i] = \frac{GM}{d[i]^2} * \frac{(0 - y[i])}{d[i]}$$