Computational Astrophysics

Exercises 2 - Week 1

January 2, 2019

1. *Lorentz Gamma Function*
   Write a program that reads the file written by the program that calculates the Lorentz gamma function in Exercises 01 and plots the corresponding curve for values of β between 0 and 1.

2. *Elliptic Orbits*
   As is well known, planets in the Solar System move in ellipses described by the general equation
   $$r = \frac{a(1-e^2)}{1+e\cos\phi} \tag{1}$$
   where $0 \leq e < 1$ is the eccentricity and $a > 0$ is the semimajor axis.Write a Python program that plots the ellipse describe by the above equation for given values of e and a.

3. *Gaussian Function*
   One of the most used functions in physics ans astronomy is the Gaussian function,
   $$f(x) = \frac{1}{\sqrt{2\pi}s}\exp\left[-\frac{1}{2}\left(\frac{x-m}{s}\right)^2\right] \tag{2}$$
   a) Write a Python program using classes to evaluate and plot the Gaussian function for given values of the real constants m and $s > 0$.

   b) The plot must be saved as .jpg and .pdf files.

4. *Planck Function*

   a) Write a Python module with a definition of Planck's function,
   $$B_\lambda(T) = \frac{2hc^2/\lambda^5}{e^{hc/\lambda k_B T}-1} \tag{3}$$
   where $c = 3{\times}10^8$ m/s^s, $k_B = 1.3806503{\times}10{-}23$ J K^{-1} and $h = 6.62606876{\times}10^{-34}$ J s.
   b) Write a Python program that uses the above module to plot Plank's function for a given value of temperature T as function of λ.

Happy Coding !!