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#!/usr/bin/env python3
# -*- coding: utf-8 -*-
"""
Python code to show spectral line, fit a Gaussian, and calculate the flux.

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"""
# Import packages
import matplotlib.pyplot as plt
import numpy as np
from scipy.optimize import curve_fit
from scipy import asarray as ar,exp

# Definition of the Gaussian we want to fit
def gaus(x,a,x0,sigma, b):
    return a*exp(-(x-x0)**2/(2*sigma**2)) + b

# Directory where the spectrum is
directory = '/home/Studenti/Desktop/sandra'
filename = 'VIS_hostGW170817_1D.txt'
# Read the spectrum from a file (.txt), and store the wavelength and flux in
    two arrays
with open(directory + filename, 'r') as f:
    lines = f.readlines()
wl = np.zeros(len(lines))
flux = np.zeros(len(lines))
for i in range(len(lines)):
    wl[i], flux[i] = lines[i].split()

#Only show the spectrum near H alpha (656.461 nm vacuum, redshifted to 663.3
    nm)
plt.ylim([-0.5e-17,1.5e-17])
plt.xlim([662,665])
plt.xlabel('Wavelength (nm)')
plt.ylabel(r'Flux (erg/(s cm$^2$)')
plt.title(r'H$\alpha$')

#Fit the gaussian

#Limits where the Gaussian is fitted
limits = np.where((wl>662.) & (wl<665))
#Initial values for the Gaussian
p0 = [1e-17,663.3,0.1,0.1]
#Try to fit a Gaussian
popt,pcov = curve_fit(gaus,wl[limits], flux[limits], p0 = p0)
# Plot the spectrum and the Gaussian, and substracting the continuum
# assuming it is the b parameter of the Gaussian(popt[3])
plt.step(wl,flux-popt[3])
plt.plot(wl[limits],gaus(wl[limits],*popt)-popt[3],'r',label='fit')
plt.show()

# Printing different properties of the spectral line
print('Central wavelength :', popt[1],'nm')
print('Line peak :',popt[0],'erg/s/cm2')
# integral of the Gaussian
print('Flux :', np.sum(gaus(wl[limits],*popt)-popt[3]),'erg/s/cm2')
```