```
import numpy as np
from scienceplots import plt
plt.style.use(["science" ,"nature"])

absrp_peaks = [0.558,0.754, 0.918,
 0.990, 1.099, 1.116,
1.164 ,  1.209 ,  1.232 ,  1.282 ,
1.300 ,  1.323 ,  1.412 ,  1.544 ,
1.604 ,  1.668 ,  1.716 ,  1.765 ,
1.799 ,  1.870]

def freq_read(datax00, datay00):
    datay00 = datay00 - datay00[0]
    # zero padding
    pad_width = int(2**int(15)-len(datay00))
    datay00 = np.pad(datay00, (0, pad_width), 'constant', constant_values=0)
    start_pos = 1
    freqx00 = np.arange(start_pos,int(len(datay00)/2)) * 1 / ((datax00[3]-
datax00[2]) * len(datay00)) * 3 / 20
    freqy00 = np.fft.fft(datay00)
    freqy00 = abs(freqy00)**2
    freqy00 = freqy00[start_pos:len(freqx00) + start_pos]
    mask1 = np.where(freqx00 < 3)
    freqx00 = freqx00[mask1]
    freqy00 = freqy00[mask1]
    mask2 = np.where(freqx00 > 0.05)
    freqx00 = freqx00[mask2]
    freqy00 = freqy00[mask2]
    return freqx00, freqy00

datax = np.loadtxt("database/res01_x_20250324_142241.csv", delimiter=",")
time_arr = datax[:, 0]
thzx = datax[:,1] * 19013/0.00587 * 1e-3 # Transfer from V to kV/cm
mask = np.where((time_arr < 20 * 3/20) & (time_arr > -5 * 3/20))
time_arr = time_arr[mask]
thzx = thzx[mask]
freqx, freqy = freq_read(time_arr, thzx)
time_arr = time_arr * 20 / 3 # Transfer the x axis from mm to ps
absrp_peaks=absrp_peaks[:2]
plt.stem(absrp_peaks,  2*10**10*np.ones_like(absrp_peaks), markerfmt="",
basefmt="", linefmt="--",label="Absorption peaks of water vapor")
plt.plot(freqx,freqy,color="black",label="THz spectrum")
plt.yscale("log")
plt.xlabel("Frequency (THz)")
```

```
plt.ylabel("Intensity (a. u.)")
plt.legend()
plt.savefig("fig/res_250324_org1.png", dpi=600)
plt.show()
plt.plot(time_arr, thzx*1e-3) # Transfer from V/cm to kV/cm
plt.xlabel("Time (ps)")
plt.ylabel("Electric Field (kV/cm)")
plt.savefig("fig/res_250324_org2.png", dpi=600)
plt.show()
```