B07c Ray-tracing Data Analysis Example

In [1]:
```
import numpy as np
import matplotlib.pyplot as plt
import pandas as pd
import scipy.interpolate as ip
```

In this example, we will plot the individual orders of the simulation result for the 400 l/mm grating at a $c_{ff} = 2$.

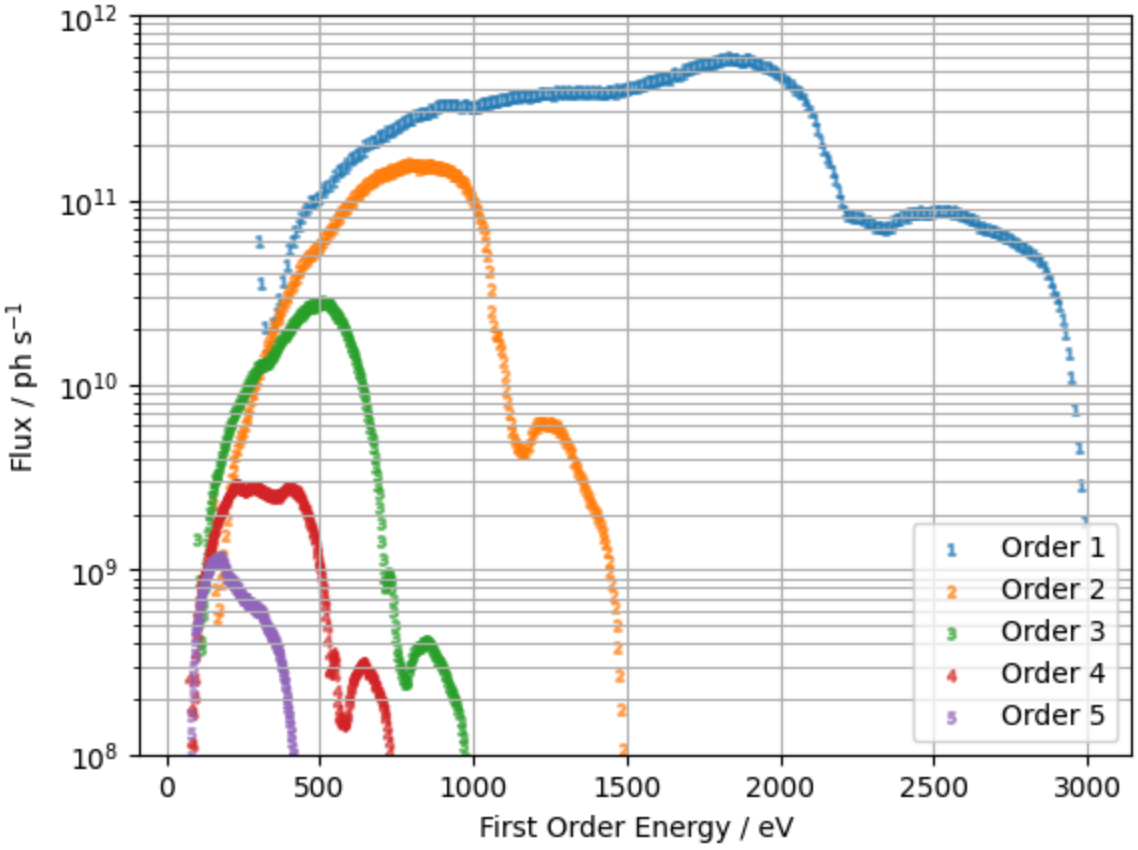
In [2]:
```
data = {i : pd.read_csv(f"./results/cff_2.0000_order_{i}.csv", skiprows=1) for i in
fluxes = {i: data[i][['E','Flux']] for i in range(1,6)}
interpolates = {i : ip.CubicSpline(fluxes[i]['E']/i, fluxes[i]['Flux']) for i in ra
```

In the above cell, we have 1. imported the data for all five orders into a dictionary, where the key is the order and the corresponding value is a pandas dataframe. We then extracted the energy and flux into the fluxes dictionary. Another dictionary of interpolated flux was also generated.

In [3]:
```
fig, ax = plt.subplots()

for order, result in fluxes.items():
    ax.scatter(result['E'] / order, result['Flux'], marker=f"${order}$", s = 15, la
ax.semilogy()
ax.set_ylim(1E8, 1E12)
ax.grid(which='both')
ax.legend()
ax.set_xlabel("First Order Energy / eV")
ax.set_ylabel("Flux / ph s$^{-1}$")
```

Out[3]:
```
Text(0, 0.5, 'Flux / ph s$^{-1}$')
```



To compare to measurements, the quantity of detector flux will need to be computed. It is a sum of the fluxes weighted by their respective orders:

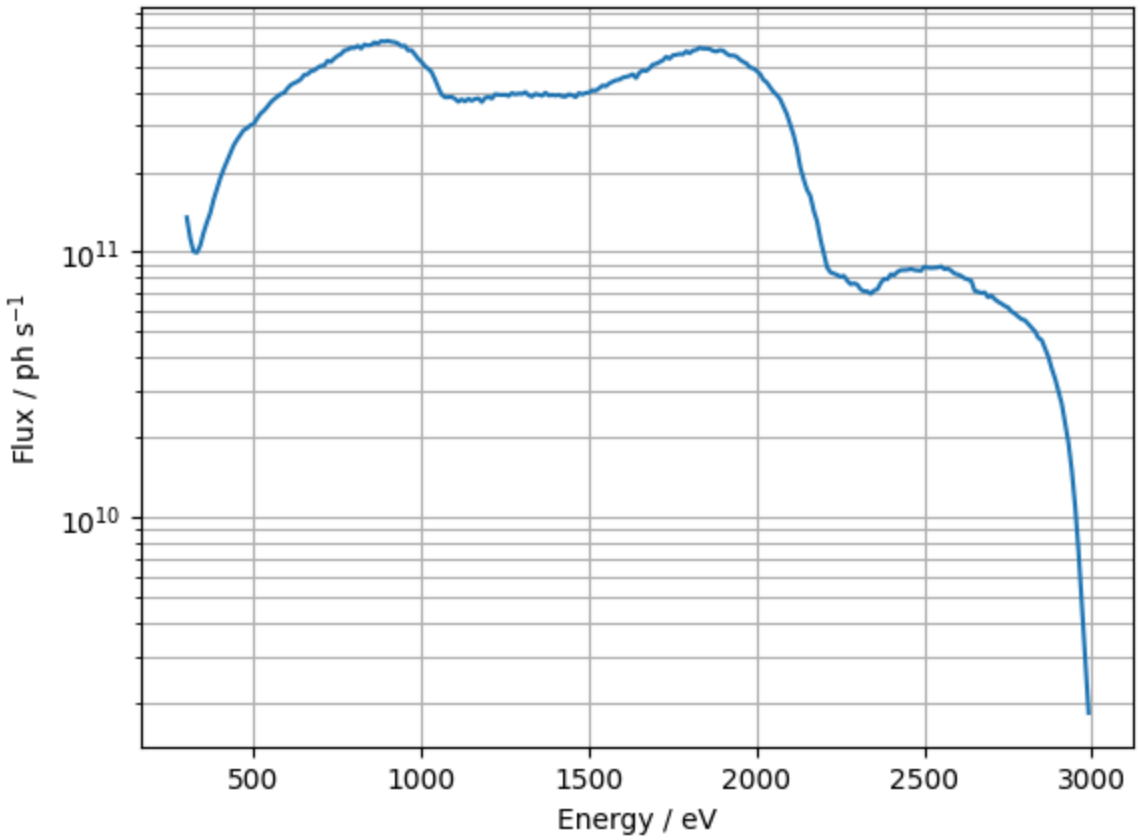
$$\text{Detector Flux} = \sum_{i \in \text{orders}} i \cdot F_i(E_{\text{First Order}})$$

where i is the order which is used as an index of summation, in our case it runs from 1 to 5. $F_i(E_{\text{First Order}})$ is the i-th order flux at first order energy.

In [4]:
```
detector = np.sum([i * interpolates[i](fluxes[1]['E']) for i in range(2,6)], axis=0
detector += fluxes[1]['Flux']

fig, ax = plt.subplots()
ax.plot(fluxes[1]['E'], detector)
ax.semilogy()
ax.grid(which='both')
ax.set_xlabel("Energy / eV")
ax.set_ylabel("Flux / ph s$^{-1}$")
```

Out[4]:
```
Text(0, 0.5, 'Flux / ph s$^{-1}$')
```



In [ ]: