Assignment_7

March 26, 2025

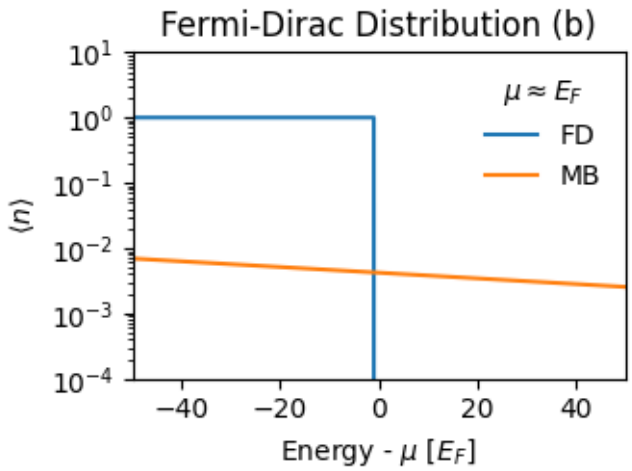
[1]:
```
import numpy as np
import matplotlib.pyplot as plt
from scipy.optimize import curve_fit
```

1 Question 3

[48]:
```
def plank_dist(E):
    kB = 1.380649e-23
    Ef = 1
    Tf = 1
    return 1/(np.exp((E-Ef)*100/(kB*Tf)) + 1)

def mb_dist(E):
    kB = 1.380649e-23
    Ef = 1
    Tf = 1
    B = 1/(100)
    return np.exp(-B*(E-Ef))

E_space = np.linspace(-100, 100, 100)                                  # Generate␣
 ↪energy (x)
plank_space = plank_dist(E_space)                                      # Generate␣
 ↪plank dist (y)
mb_space = mb_dist(E_space)                                            # Generate␣
 ↪boltz dist (y)
mb_norm_factor = np.sum(mb_space)*np.mean(np.diff(E_space))
mb_space /= mb_norm_factor                                             # Normalize␣
 ↪boltz dist

fig, ax = plt.subplots(1, 1, figsize=(3.3,2.2))
ax.plot(E_space, plank_space, label='FD')

ax.set(yscale='log', ylim=(1e-4, 1e1), xlim=(-50, 50),
       xlabel=r'Energy - $\mu$ [$E_F$]', ylabel=r'$\langle n \rangle$',
       title="Fermi-Dirac Distribution (b)")
ax.legend(framealpha=0, title=r"$\mu \approx E_F$")
plt.savefig('plots/3_b.png', dpi=300)
```

```
ax.plot(E_space, mb_space, label='MB')
ax.legend(framealpha=0, title=r"$\mu \approx E_F$")
plt.savefig('plots/3_c.png', dpi=300)
plt.show()
```

```
C:\Users\hamis\AppData\Local\Temp\ipykernel_28664\2125313639.py:5:
RuntimeWarning: overflow encountered in exp
  return 1/(np.exp((E-Ef)*100/(kB*Tf)) + 1)
```



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