In [ ]:
```
import numpy as np
print(np.version.version)
from numpy import loadtxt
import matplotlib.pyplot as plt
from scipy.optimize import curve_fit
import glob
from numpy import diff
import pandas as pn
import math
import scipy.constants as sc
import pickle
import copy
from scipy import interpolate
from matplotlib import rcParams, cycler, cm, rc
plotall = True
overview_plot = True
from pylab import meshgrid,cm,imshow,contour,clabel,colorbar,axis,title,show,pcolor
import pandas as pd
import os
import matplotlib.ticker as ticker
from matplotlib.ticker import ScalarFormatter,FormatStrFormatter, FuncFormatter
from matplotlib.ticker import (MultipleLocator, AutoMinorLocator)
from numpy.polynomial import Polynomial
import matplotlib.cm as cm
import matplotlib as mpl
import matplotlib.font_manager as font_manager
import matplotlib.lines as mlines
from matplotlib.ticker import LogFormatter
```

Folder Paths

In [ ]:
```
"---Folder Paths---"


folder_RT_film_cleaned = r"C:\Users\pblah\Data\Navy Beach\FM318\Film\RT\Cleaned"
pathlist_RT_film_cleaned = folderpath(folder_RT_film_cleaned)

folder_RT_film_cleaned_trimmed = r"C:\Users\pblah\Data\Navy Beach\FM318\Film\RT\Cleaned\EDITED
pathlist_RT_film_cleaned_trimmed = folderpath(folder_RT_film_cleaned_trimmed)

folder_RT_film_pandas = r"C:\Users\pblah\Data\Navy Beach\FM318\Data\Film\RT"
pathlist_RT_film_pandas = folderpath_csv(folder_RT_film_pandas)



print(pathlist_RT_film_cleaned)
print(pathlist_RT_film_cleaned_trimmed)
print(pathlist_RT_film_pandas)
```

RT

In [ ]:
```
fig,ax = plt.subplots(figsize=(12,12), dpi = 500)

colours = ['dodgerblue','dodgerblue']
RT_type = ['cooldown','warmup']

for i,data in enumerate(pathlist_RT_film_cleaned_trimmed):

    #print("i",i)
    #print("data",data)

    dataextracted = dataextractorRT(data)
    temperature = dataextracted[0]
    resistance2pt = dataextracted[1]
    resitivity2pt = resistance2pt *22.86E-9*(np.pi/np.log(2))*1E2*1E6 #Resitivity formula

    resistance4pt = dataextracted[3]
    print(resistance4pt)
    resitivity4pt = resistance4pt *22.86E-9*(np.pi/np.log(2))*1E2*1E6 #Resitivity formula
    print(resitivity4pt)
    #plt.plot(temperature,resistance4pt,label = labels[i],color = colours_1K[i])
    plt.plot(temperature,resitivity4pt,color = colours[i])
    pd.DataFrame({'temperature':temperature,'resistance2pt':resistance2pt,'resitivity2pt'
    pd.DataFrame({'temperature':temperature,'resistance2pt':resistance2pt,'resitivity2pt'
    'FM318' + '_' + str(i) + '_' + 'Film_RvsT' + '_' + str(RT_type[i]) + '.csv')
    pd.DataFrame({'temperature':temperature,'resistance2pt':resistance2pt,'resitivity2pt'
    'FM318' + '_' + str(i) + '_' + 'Film_RvsT' + '_' + str(RT_type[i]) + '.csv')

plt.yscale('log')
ax.spines["top"].set_linewidth(2.5)
ax.spines["bottom"].set_linewidth(2.5)
ax.spines["right"].set_linewidth(2.5)
ax.spines["left"].set_linewidth(2.5)
#ax.spines["left"].set_bounds(-3.5,3.5)
#ax.spines["right"].set_bounds(-3.5,3.5)
#ax.spines["top"].set_position(['data',3.5])
#ax.spines["bottom"].set_position(['data',-3.5])


ax.tick_params(axis='x', which='major', labelsize=40, length = 10, width = 2, direction
ax.tick_params(axis='y', which='major', labelsize=40, length = 20, width = 2, direction
ax.tick_params(axis='y', which='minor', labelsize=40, length = 20, width = 2, direction


plt.title("FM318 Film RT",fontsize = 40, pad = 20)
plt.ylabel(r'$\rho (\mu\Omega\cdot \mathrm{cm})$',fontsize=40, labelpad = 20)
plt.xlabel("T(K)",fontsize=40, labelpad = 20)


plt.savefig(r"C:\Users\pblah\Data\Navy Beach\FM318\Figures\FM318_Film_RT.pdf",bbox_inches
plt.savefig(r"C:\Users\pblah\Data\Navy Beach\FM318\Figures\FM318_Film_RT.png",bbox_inches
plt.show()
```

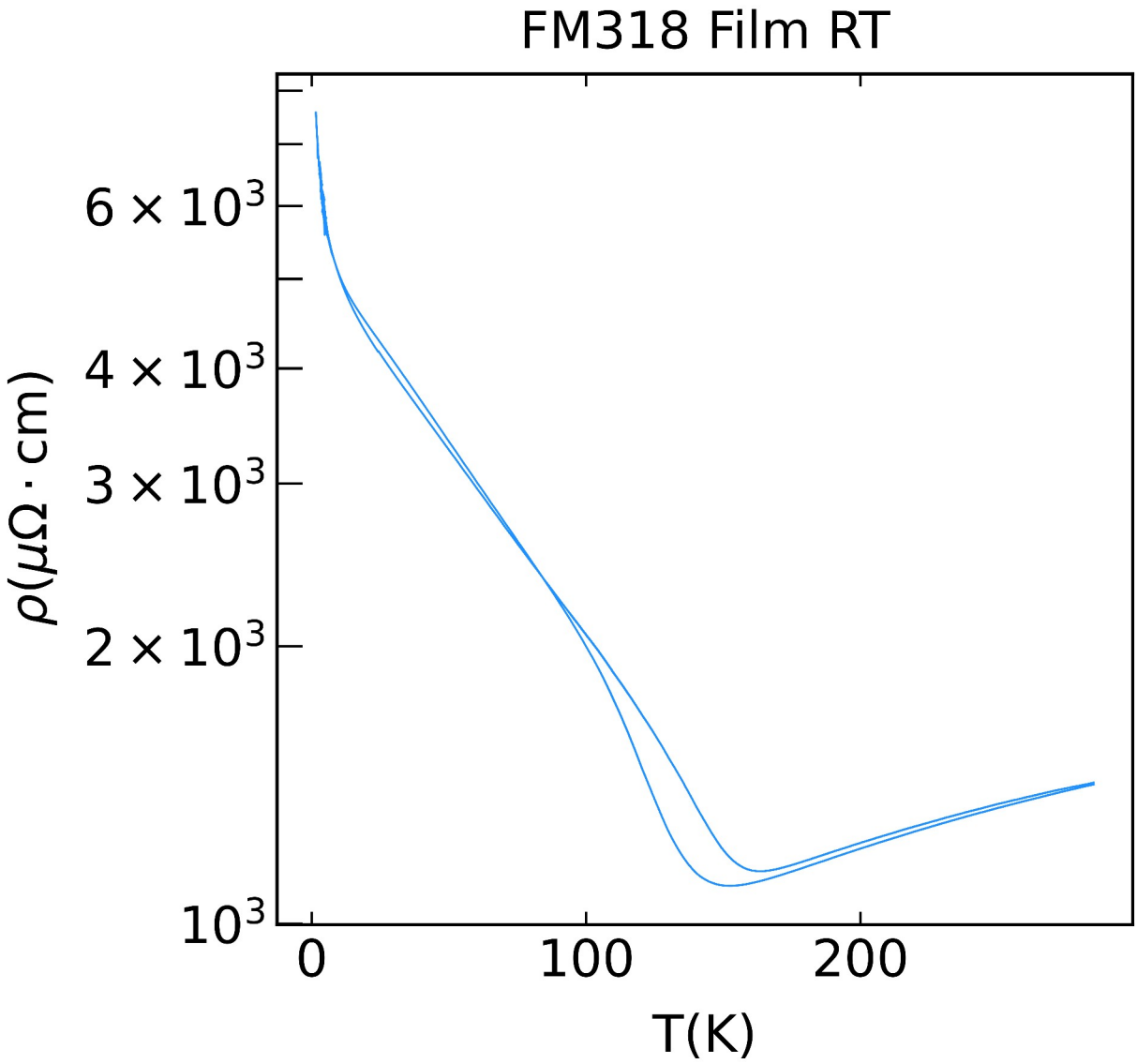
```
### Experimenting with log scales ###

#plt.yscale('log')
#ax.yaxis.set_major_formatter(ticker.FuncFormatter(sci_notation))
#ax.get_yaxis().set_minor_formatter(ticker.LogFormatter())
#locmin = matplotlib.ticker.LogLocator(subs='all')
#locmax = matplotlib.ticker.LogLocator(subs='all', numticks = 20)
#ax.yaxis.set_minor_locator(locmin)
#ax.yaxis.set_minor_locator(locmax)
#ax.get_yaxis().set_major_formatter(matplotlib.ticker.LogFormatterSciNotation(base=10))
#ax.get_yaxis().set_minor_formatter(matplotlib.ticker.LogFormatterSciNotation(base=10))
#locmax = matplotlib.ticker.LogLocator(base=10.0, subs = (1,2,3,4,5,6,7,8,9,11))
#locmin = matplotlib.ticker.LogLocator(numticks=12)
#ax.yaxis.set_major_locator(locmax)
#ax.yaxis.set_minor_locator(locmin)
#plt.yticks(fontsize=20)
#plt.xticks(fontsize=20)
#plt.xlim(160,300)
#plt.ylim(1E3,1.5E3)
#ax.set_xticks(range(0,320,50))
#ax.ticklabel_format(axis = 'both',style = 'sci')
#ax.set_yticks(np.logspace(3,4,num=3,base=10),minor=False)
#ax.get_yaxis().set_minor_formatter(matplotlib.ticker.LogFormatterSciNotation(base=10,minor_t
#ax.tick_params(axis='both', which='major', labelsize=25)
#ax.tick_params(axis='both', which='minor', labelsize=15)
#ax.get_yaxis().set_minor_formatter(matplotlib.ticker.FormatStrFormatter('%.2e'))
```

In [8]:

```
fig,ax = plt.subplots(figsize=(12,12), dpi = 500)

colours = ['dodgerblue','dodgerblue']
RT_type = ['cooldown','warmup']

for i,data in enumerate(pathlist_RT_film_cleaned_trimmed):

    #print("i",i)
    #print("data",data)

    dataextracted = dataextractorRT(data)
    temperature = dataextracted[0]
    resistance2pt = dataextracted[1]
    resitivity2pt = resistance2pt *22.86E-9*(np.pi/np.log(2))*1E2*1E6

    resistance4pt = dataextracted[3]
    print(resistance4pt)
    resitivity4pt = resistance4pt *22.86E-9*(np.pi/np.log(2))*1E2*1E6
    print(resitivity4pt)
    #plt.plot(temperature,resistance4pt,label = labels[i],color = colours_1K[i])
    plt.plot(temperature,resitivity4pt,color = colours[i])
    pd.DataFrame({'temperature':temperature,'resistance2pt':resistance2pt,'resitivity2pt'
    pd.DataFrame({'temperature':temperature,'resistance2pt':resistance2pt,'resitivity2pt'
    'FM318' + '_' + str(i) + '_' + 'Film_RvsT' + '_' + str(RT_type[i]) + '.csv')
    pd.DataFrame({'temperature':temperature,'resistance2pt':resistance2pt,'resitivity2pt'
    'FM318' + '_' + str(i) + '_' + 'Film_RvsT' + '_' + str(RT_type[i]) + '.csv')

plt.yscale('log')
```

```
ax.spines["top"].set_linewidth(2.5)
ax.spines["bottom"].set_linewidth(2.5)
ax.spines["right"].set_linewidth(2.5)
ax.spines["left"].set_linewidth(2.5)
#ax.spines["left"].set_bounds(-3.5,3.5)
#ax.spines["right"].set_bounds(-3.5,3.5)
#ax.spines["top"].set_position(['data',3.5])
#ax.spines["bottom"].set_position(['data',-3.5])


ax.tick_params(axis='x', which='major', labelsize=40, length = 10, width = 2, direction
ax.tick_params(axis='y', which='major', labelsize=40, length = 20, width = 2, direction
ax.tick_params(axis='y', which='minor', labelsize=40, length = 20, width = 2, direction


plt.title("FM318 Film RT",fontsize = 40, pad = 20)
plt.ylabel(r'$\rho (\mu\Omega\cdot \mathrm{cm})$',fontsize=40, labelpad = 20)
plt.xlabel("T(K)",fontsize=40, labelpad = 20)


#plt.savefig(r"C:\Users\pblah\Data\Navy Beach\FM318\Figures\FM318_Film_RT.pdf",bbox_inches =
#plt.savefig(r"C:\Users\pblah\Data\Navy Beach\FM318\Figures\FM318_Film_RT.png",bbox_inches =
plt.show()



plt.yscale('log')
#ax.yaxis.set_major_formatter(ticker.FuncFormatter(sci_notation))
#ax.get_yaxis().set_minor_formatter(ticker.LogFormatter())
#locmin = matplotlib.ticker.LogLocator(subs='all')
#locmax = matplotlib.ticker.LogLocator(subs='all', numticks = 20)
#ax.yaxis.set_minor_locator(locmin)
#ax.yaxis.set_minor_locator(locmax)
#ax.get_yaxis().set_major_formatter(matplotlib.ticker.LogFormatterSciNotation(base=10))
#ax.get_yaxis().set_minor_formatter(matplotlib.ticker.LogFormatterSciNotation(base=10))
#locmax = matplotlib.ticker.LogLocator(base=10.0, subs = (1,2,3,4,5,6,7,8,9,11))
#locmin = matplotlib.ticker.LogLocator(numticks=12)
#ax.yaxis.set_major_locator(locmax)
#ax.yaxis.set_minor_locator(locmin)
#plt.yticks(fontsize=20)
#plt.xticks(fontsize=20)
#plt.xlim(160,300)
#plt.ylim(1E3,1.5E3)
#ax.set_xticks(range(0,320,50))
#ax.ticklabel_format(axis = 'both',style = 'sci')
#ax.set_yticks(np.logspace(3,4,num=3,base=10),minor=False)
#ax.get_yaxis().set_minor_formatter(matplotlib.ticker.LogFormatterSciNotation(base=10,minor_t
#ax.tick_params(axis='both', which='major', labelsize=25)
#ax.tick_params(axis='both', which='minor', labelsize=15)
#ax.get_yaxis().set_minor_formatter(matplotlib.ticker.FormatStrFormatter('%.2e'))
```

```
[136.64844876 136.63308471 136.63671507 ... 731.2882283  731.2882283
 731.2882283 ]
[1415.81120022 1415.65201373 1415.6896278  ... 7576.85925904 7576.85925904
 7576.85925904]
[726.44360414 726.41549237 726.44360414 ... 137.24965692 137.24406077
 137.28361133]
[7526.66422788 7526.37296255 7526.66422788 ... 1422.04030307 1421.98232158
 1422.39210397]
```



Combining into a Single Curve

In [ ]:
```
labels = ["FM318_Film"]
samples_dict = {}

single_curves_list_temperature = []
single_curves_list_resitivity4pt = []

for i,path in enumerate(pathlist_RT_film_pandas):

    x = pd.read_csv(path)
    Temperature = pd.DataFrame(x).temperature.values.tolist()
    Resitivity_4pt = pd.DataFrame(x).resitivity4pt.values.tolist()

    single_curves_list_temperature.append(Temperature)
    single_curves_list_resitivity4pt.append(Resitivity_4pt)


### Exporting Single Curves as Dataframes ###
for i, name in enumerate(labels):

    samples_dict[labels[i] + '_' + 't' + '_' + 'full'] = single_curves_list_temperature
    samples_dict[labels[i] + '_' + 'r4pt' + '_' + 'full'] = single_curves_list_resitivity4pt

    pd.DataFrame({'temperature':samples_dict[labels[i] + '_' + 't' + '_' + 'full'],
    str(labels[0]) + '_' + 'RvsT_Full' + '.csv')
```