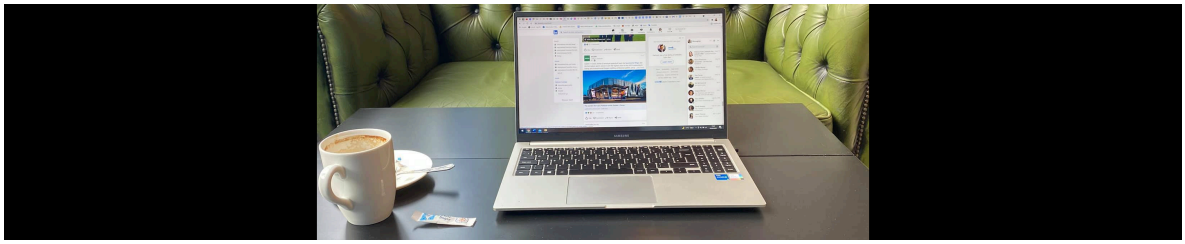
SIMPLE MOVING AVERAGE AND EXPONENTIAL MOVING AVERAGE



In [ ]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
import yfinance as yf
from datetime import date
import warnings
warnings.filterwarnings("ignore")
```

In [2]:
```
ticker_1 = '^FTSE'
ticker_2 = '^FTMC'
```

In [3]:
```
ftse_100 = yf.download(ticker_1, start='2013-01-01', end=date.today())
```

```
[**********************100%**********************]  1 of 1 completed
```

In [4]:
```
ftse_250 = yf.download(ticker_2, start='2013-01-01', end=date.today())
```

```
[**********************100%**********************]  1 of 1 completed
```

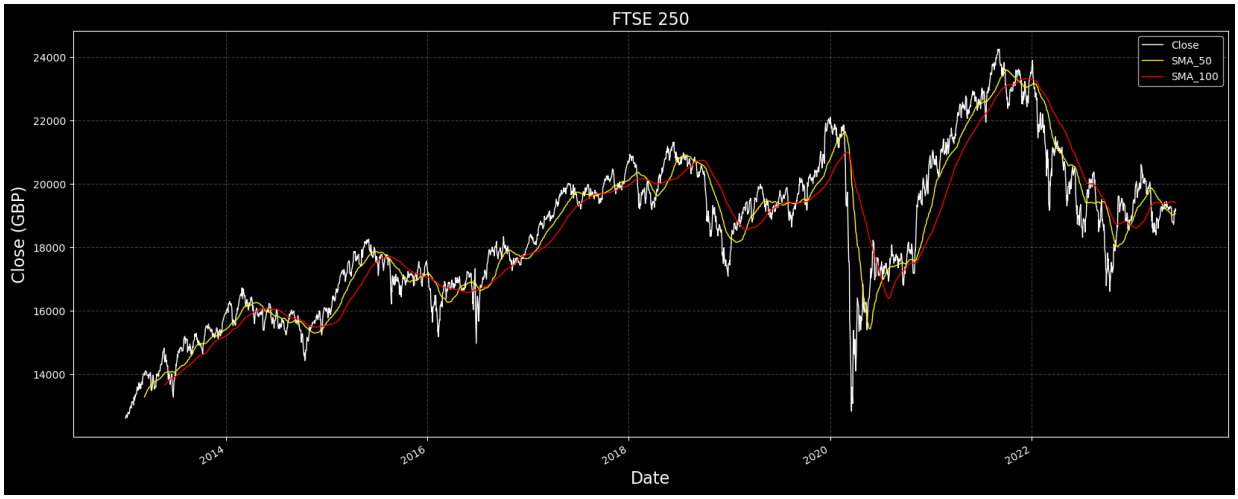
SMA = (Sum of data points) / (Number of data points)

For example, if you want to calculate the 50-day SMA, you would sum up the closing prices of the last 50 days and divide the sum by 50.

In [5]:
```
period_50 = 50
period_100 = 100

ftse_100['SMA_50'] = ftse_100.Close.rolling(period_50).mean()
ftse_100['SMA_100'] = ftse_100.Close.rolling(period_100).mean()

ftse_250['SMA_50'] = ftse_250.Close.rolling(period_50).mean()
ftse_250['SMA_100'] = ftse_250.Close.rolling(period_100).mean()
```

In [6]:
```
plt.style.use('dark_background')
plt.figure(figsize=(20, 8), linewidth=6)
ftse_100['Close'].plot(color="cyan", linewidth=1)
ftse_100['SMA_50'].plot(color="yellow", linewidth=1)
ftse_100['SMA_100'].plot(color="red", linewidth=1)
plt.xlabel('Date', fontsize=16, color="cyan")
plt.ylabel('Close (GBP)', fontsize=16, color="cyan")
plt.title('FTSE 100', fontsize=16, color="cyan")
plt.grid(linestyle="--", color="cyan", alpha=0.5)
plt.xticks(color="cyan")
plt.yticks(color="cyan")
plt.legend()
plt.show()
```

In [7]:
```
plt.style.use('dark_background')
plt.figure(figsize=(20, 8), linewidth=6)
ftse_250['Close'].plot(color="white", linewidth=1)
ftse_250['SMA_50'].plot(color="yellow", linewidth=1)
ftse_250['SMA_100'].plot(color="red", linewidth=1)
plt.xlabel('Date', fontsize=16, color="white")
plt.ylabel('Close (GBP)', fontsize=16, color="white")
plt.title('FTSE 250', fontsize=16, color="white")
plt.grid(linestyle="--", color="grey", alpha=0.5)
plt.legend()
plt.show()
```



EMA = (Closing Price - Previous EMA) * (Smoothing Factor) + Previous EMA

The smoothing factor determines the weightage assigned to the current and previous EMA values. The smoothing factor is calculated using the following formula:

Smoothing Factor = (2 / (Number of periods + 1))

1. Calculate the smoothing factor (SF):

SF = (2 / (N + 1))

N is the number of periods or days, so in this case, N = 50.

SF = (2 / (50 + 1)) = 0.0392

2. Calculate the initial Simple Moving Average (SMA):

SMA = (Sum of closing prices for the first 50 days) / N

For the given data, the initial SMA would be calculated as follows:

SMA = (182.009995 + 179.699997 + ... + 172.169998) / 50

3. Calculate the first EMA:

EMA_1 = (Closing Price - Previous EMA) * SF + Previous EMA

For the given data, the first EMA would be calculated as follows:

EMA_1 = (182.009995 - SMA) * SF + SMA

4. Calculate the subsequent EMAs iteratively using the formula:

EMA*i* = *(Closing Price - EMA*(i-1)) * SF + EMA_(i-1)

For example, to calculate EMA_2, you would use the following formula:

EMA_2 = (179.699997 - EMA_1) * SF + EMA_1

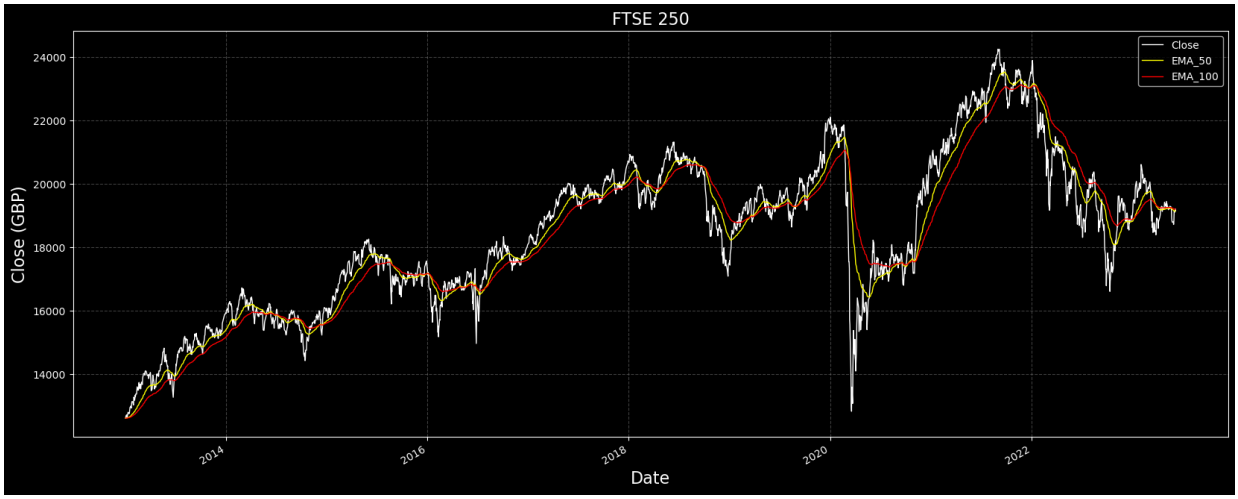
And continue this process for the remaining data points.

In [8]:
```
ema_period_1 = 50
ema_period_2 = 100
```

In [9]:
```
ftse_100['EMA_50'] = ftse_100['Close'].ewm(span=ema_period_1, adjust=Fals
ftse_100['EMA_100'] = ftse_100['Close'].ewm(span=ema_period_2, adjust=Fal
ftse_250['EMA_50'] = ftse_250['Close'].ewm(span=ema_period_1, adjust=Fals
ftse_250['EMA_100'] = ftse_250['Close'].ewm(span=ema_period_2, adjust=Fal
```

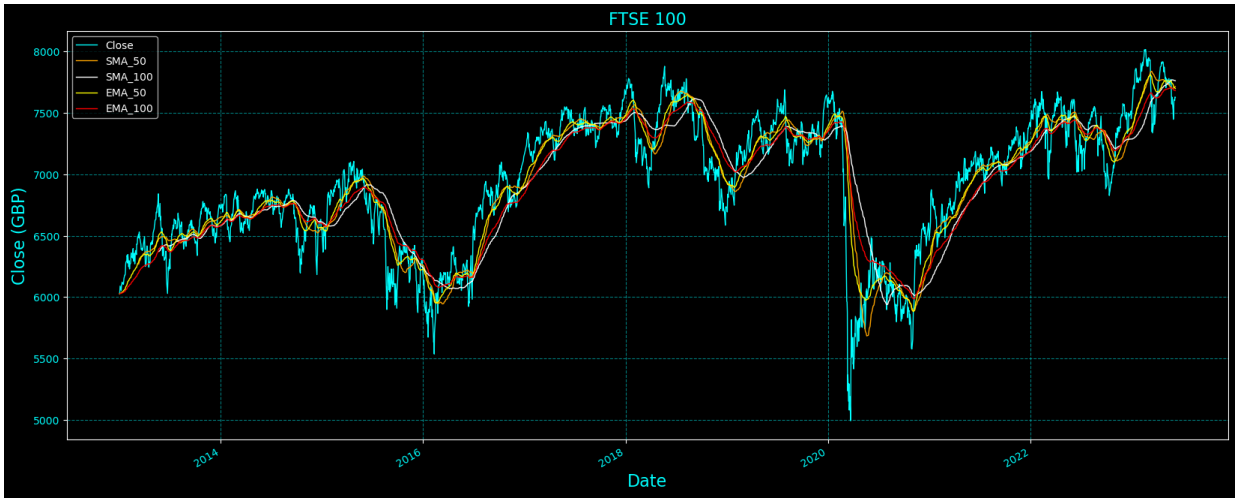
In [10]:
```
plt.style.use('dark_background')
plt.figure(figsize=(20, 8), linewidth=6)
ftse_100['Close'].plot(color="cyan", linewidth=1)
ftse_100['EMA_50'].plot(color="yellow", linewidth=1)
ftse_100['EMA_100'].plot(color="red", linewidth=1)
plt.xlabel('Date', fontsize=16, color="cyan")
plt.ylabel('Close (GBP)', fontsize=16, color="cyan")
plt.title('FTSE 100', fontsize=16, color="cyan")
plt.grid(linestyle="--", color="cyan", alpha=0.5)
plt.xticks(color="cyan")
plt.yticks(color="cyan")
plt.legend()
plt.show()
```

In [11]:
```
plt.style.use('dark_background')
plt.figure(figsize=(20, 8), linewidth=6)
ftse_250['Close'].plot(color="white", linewidth=1)
ftse_250['EMA_50'].plot(color="yellow", linewidth=1)
ftse_250['EMA_100'].plot(color="red", linewidth=1)
plt.xlabel('Date', fontsize=16, color="white")
plt.ylabel('Close (GBP)', fontsize=16, color="white")
plt.title('FTSE 250', fontsize=16, color="white")
plt.grid(linestyle="--", color="grey", alpha=0.5)
plt.legend()
plt.show()
```

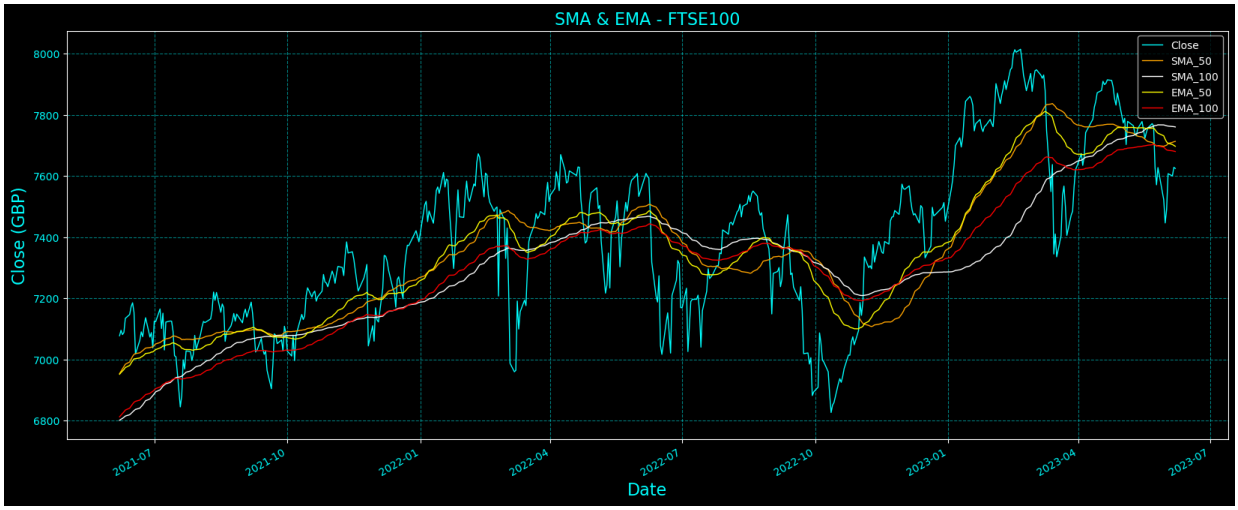


COMPARISION BETWEEN SMA & EMA (FTSE100)

In [12]:
```
plt.style.use('dark_background')
plt.figure(figsize=(20, 8), linewidth=6)
ftse_100['Close'].plot(color="cyan", linewidth=1)

ftse_100['SMA_50'].plot(color="orange", linewidth=1)
ftse_100['SMA_100'].plot(color="white", linewidth=1)

ftse_100['EMA_50'].plot(color="yellow", linewidth=1)
ftse_100['EMA_100'].plot(color="red", linewidth=1)
plt.xlabel('Date', fontsize=16, color="cyan")
plt.ylabel('Close (GBP)', fontsize=16, color="cyan")
plt.title('FTSE 100', fontsize=16, color="cyan")
plt.grid(linestyle="--", color="cyan", alpha=0.5)
plt.xticks(color="cyan")
plt.yticks(color="cyan")
plt.legend()
plt.show()
```

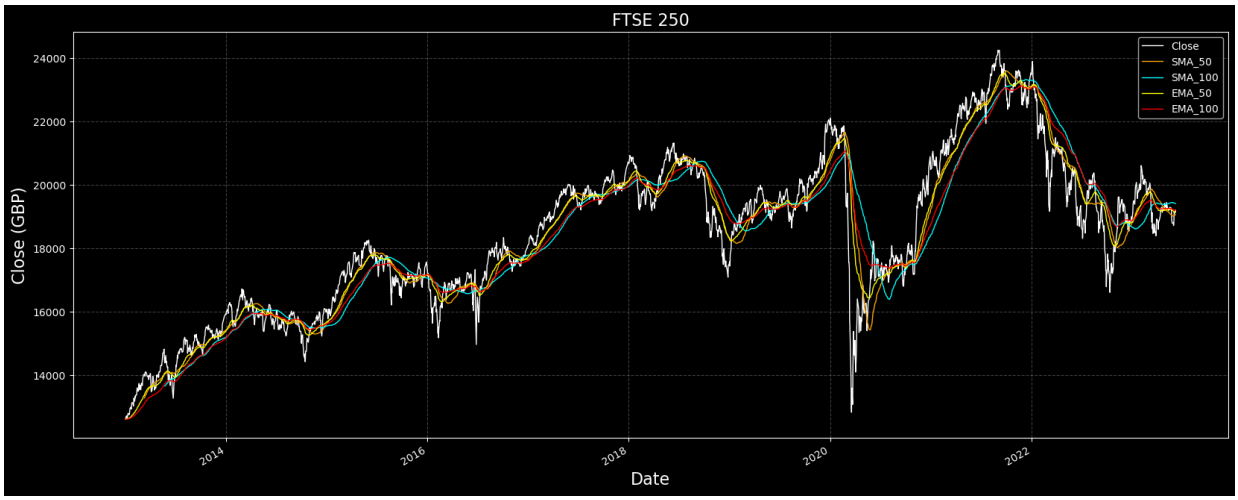


In [13]:
```
plt.style.use('dark_background')
plt.figure(figsize=(20, 8), linewidth=6)
ftse_100['Close'].tail(252*2).plot(color="cyan", linewidth=1)

ftse_100['SMA_50'].tail(252*2).plot(color="orange", linewidth=1)
ftse_100['SMA_100'].tail(252*2).plot(color="white", linewidth=1)

ftse_100['EMA_50'].tail(252*2).plot(color="yellow", linewidth=1)
ftse_100['EMA_100'].tail(252*2).plot(color="red", linewidth=1)
plt.xlabel('Date', fontsize=16, color="cyan")
plt.ylabel('Close (GBP)', fontsize=16, color="cyan")
plt.title('SMA & EMA - FTSE100', fontsize=16, color="cyan")
plt.grid(linestyle="--", color="cyan", alpha=0.5)
plt.xticks(color="cyan")
plt.yticks(color="cyan")
plt.legend()
plt.show()
```



COMPARISION BETWEEN SMA & EMA (FTSE250)

In [14]:
```
plt.style.use('dark_background')
plt.figure(figsize=(20, 8), linewidth=6)
ftse_250['Close'].plot(color="white", linewidth=1)
ftse_250['SMA_50'].plot(color="orange", linewidth=1)
ftse_250['SMA_100'].plot(color="cyan", linewidth=1)
ftse_250['EMA_50'].plot(color="yellow", linewidth=1)
ftse_250['EMA_100'].plot(color="red", linewidth=1)
plt.xlabel('Date', fontsize=16, color="white")
plt.ylabel('Close (GBP)', fontsize=16, color="white")
plt.title('FTSE 250', fontsize=16, color="white")
plt.grid(linestyle="--", color="grey", alpha=0.5)
plt.legend()
plt.show()
```



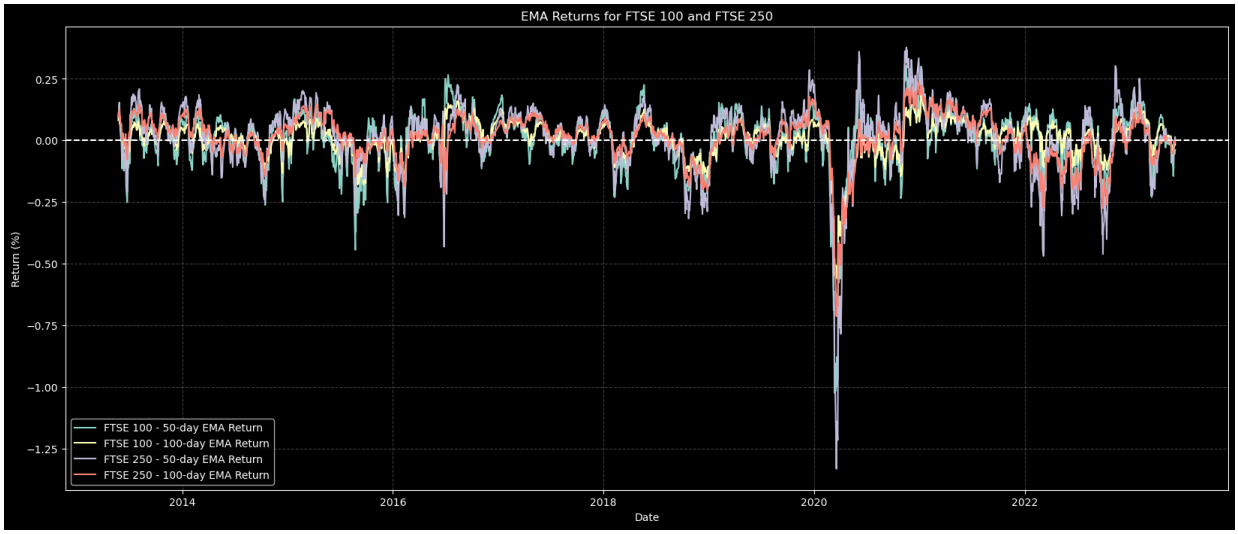
In [15]:
```
plt.style.use('dark_background')
plt.figure(figsize=(20, 8), linewidth=6)
ftse_250['Close'].tail(252*2).plot(color="white", linewidth=1)
ftse_250['SMA_50'].tail(252*2).plot(color="orange", linewidth=1)
ftse_250['SMA_100'].tail(252*2).plot(color="cyan", linewidth=1)
ftse_250['EMA_50'].tail(252*2).plot(color="yellow", linewidth=1)
ftse_250['EMA_100'].tail(252*2).plot(color="red", linewidth=1)
plt.xlabel('Date', fontsize=16, color="white")
plt.ylabel('Close (GBP)', fontsize=16, color="white")
plt.title('FTSE 250', fontsize=16, color="white")
plt.grid(linestyle="--", color="grey", alpha=0.5)
plt.legend()
plt.show()
```

RETURN

In [16]:
```
ftse_100['EMA_50_Return'] = ftse_100['EMA_50'].pct_change() * 100
ftse_100['EMA_100_Return'] = ftse_100['EMA_100'].pct_change() * 100
ftse_250['EMA_50_Return'] = ftse_250['EMA_50'].pct_change() * 100
ftse_250['EMA_100_Return'] = ftse_250['EMA_100'].pct_change() * 100
```

In [17]:
```
ftse_100.dropna(inplace=True)
ftse_250.dropna(inplace=True)
```

In [18]:
```
plt.style.use('dark_background')
plt.figure(figsize=(20, 8), linewidth=6)
plt.plot(ftse_100.index, ftse_100['EMA_50_Return'], label='FTSE 100 - 50-
plt.plot(ftse_100.index, ftse_100['EMA_100_Return'], label='FTSE 100 - 10
plt.plot(ftse_250.index, ftse_250['EMA_50_Return'], label='FTSE 250 - 50-
plt.plot(ftse_250.index, ftse_250['EMA_100_Return'], label='FTSE 250 - 10
plt.xlabel('Date')
plt.ylabel('Return (%)')
plt.title('EMA Returns for FTSE 100 and FTSE 250')
plt.axhline(0, linestyle="--")
plt.legend()
plt.grid(linestyle="--", color="grey", alpha=0.5)
plt.show()
```

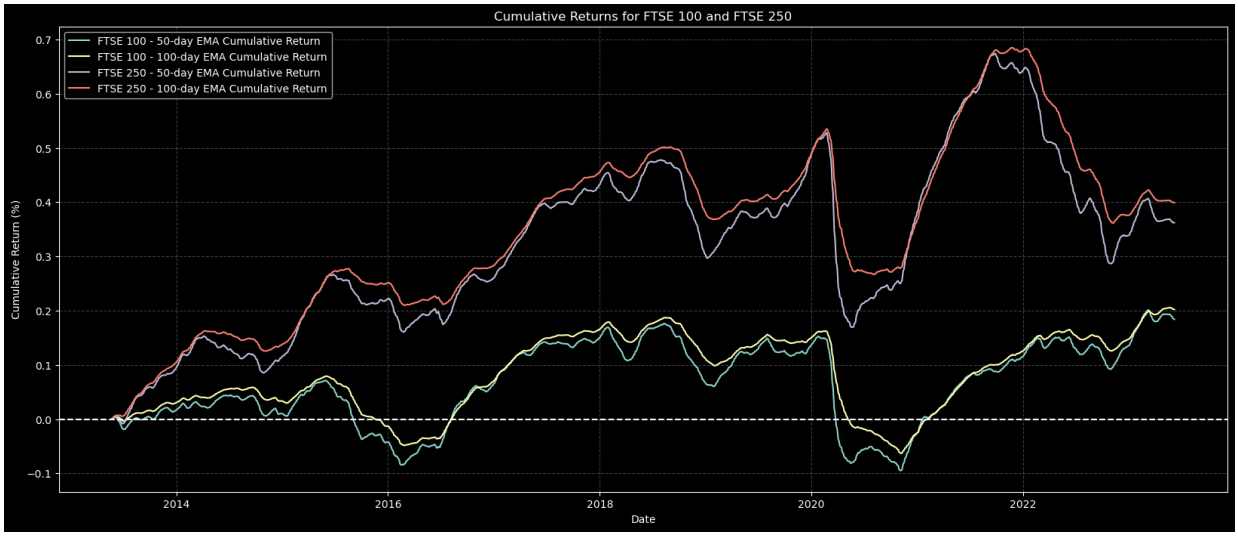


CUMULATIVE RETURNS

In [19]:
```
ftse_100['EMA_50_Cumulative_Return'] = (1 + ftse_100['EMA_50_Return'] / 1
ftse_100['EMA_100_Cumulative_Return'] = (1 + ftse_100['EMA_100_Return'] /
ftse_250['EMA_50_Cumulative_Return'] = (1 + ftse_250['EMA_50_Return'] / 1
ftse_250['EMA_100_Cumulative_Return'] = (1 + ftse_250['EMA_100_Return'] /
```

In [20]:
```
ftse_100.dropna(inplace=True)
ftse_250.dropna(inplace=True)
```

In [21]:
```
plt.style.use('dark_background')
plt.figure(figsize=(20, 8), linewidth=6)
plt.plot(ftse_100.index, ftse_100['EMA_50_Cumulative_Return'], label='FTS
plt.plot(ftse_100.index, ftse_100['EMA_100_Cumulative_Return'], label='FT
plt.plot(ftse_250.index, ftse_250['EMA_50_Cumulative_Return'], label='FTS
plt.plot(ftse_250.index, ftse_250['EMA_100_Cumulative_Return'], label='FT
plt.xlabel('Date')
plt.ylabel('Cumulative Return (%)')
plt.title('Cumulative Returns for FTSE 100 and FTSE 250')
plt.axhline(0, linestyle="--")
plt.legend()
plt.grid(linestyle="--", color="grey", alpha=0.5)
plt.show()
```

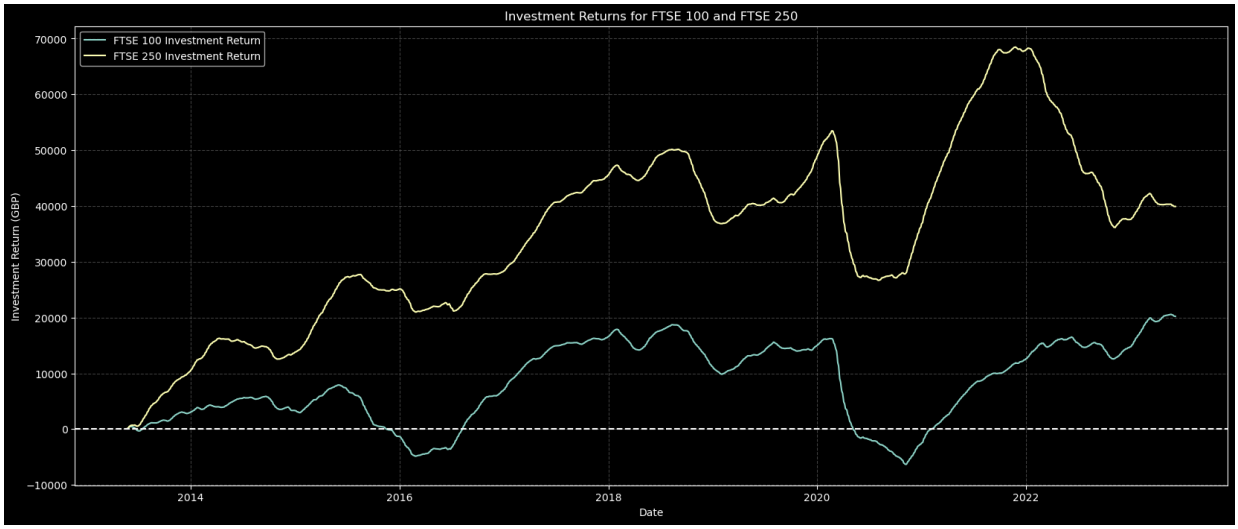


In [22]:
```
initial_investment = 100_000
```

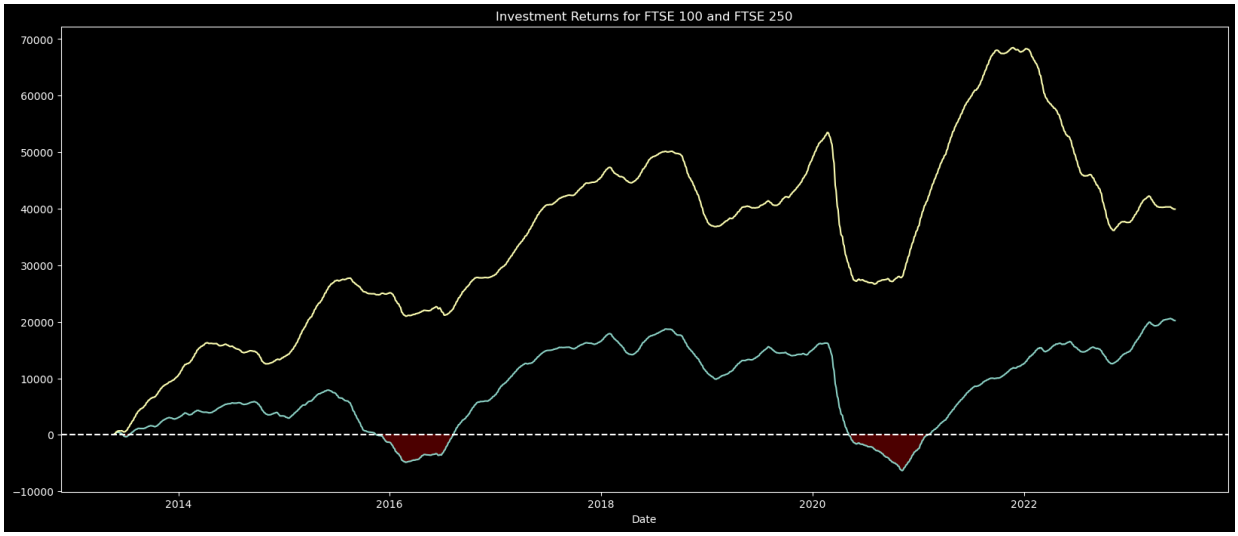
In [52]:
```
ftse_100['Investment_Return'] = ftse_100['EMA_100_Cumulative_Return'] * i
ftse_250['Investment_Return'] = ftse_250['EMA_100_Cumulative_Return'] * i
```

In [53]:
```
ftse_100.dropna(inplace=True)
ftse_250.dropna(inplace=True)
```

In [54]:
```
plt.style.use('dark_background')
plt.figure(figsize=(20, 8), linewidth=6)
plt.plot(ftse_100.index, ftse_100['Investment_Return'], label='FTSE 100 I
plt.plot(ftse_250.index, ftse_250['Investment_Return'], label='FTSE 250 I
plt.xlabel('Date')
plt.ylabel('Investment Return (GBP)')
plt.title('Investment Returns for FTSE 100 and FTSE 250')
plt.axhline(0, linestyle="--")
plt.legend()
plt.grid(linestyle="--", color="grey", alpha=0.5)
plt.show()
```

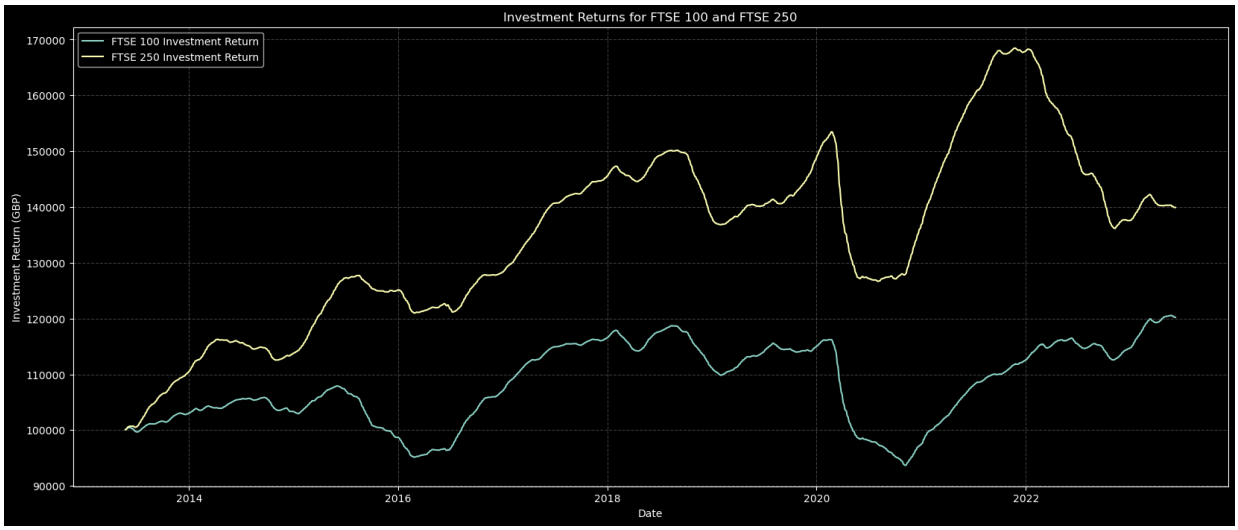


In [55]:
```
plt.style.use('dark_background')
plt.figure(figsize=(20, 8), linewidth=6)
plt.plot(ftse_100.index, ftse_100['Investment_Return'], label='FTSE 100 I
plt.plot(ftse_250.index, ftse_250['Investment_Return'], label='FTSE 250 I
plt.fill_between(ftse_100.index, ftse_100['Investment_Return'], where=fts
plt.fill_between(ftse_250.index, ftse_250['Investment_Return'], where=fts
plt.title('Investment Returns for FTSE 100 and FTSE 250')
plt.axhline(0, linestyle="--")
plt.xlabel('Date')
plt.show()
```



In [56]:
```
ftse_100['Investment_Return'] = ftse_100['EMA_100_Cumulative_Return'] * i
ftse_250['Investment_Return'] = ftse_250['EMA_100_Cumulative_Return'] * i
```

In [59]:
```
plt.style.use('dark_background')
plt.figure(figsize=(20, 8), linewidth=6)
plt.plot(ftse_100.index, ftse_100['Investment_Return'], label='FTSE 100 I
plt.plot(ftse_250.index, ftse_250['Investment_Return'], label='FTSE 250 I
plt.xlabel('Date')
plt.ylabel('Investment Return (GBP)')
plt.title('Investment Returns for FTSE 100 and FTSE 250')
plt.legend()
plt.grid(linestyle="--", color="grey", alpha=0.5)
plt.show()
```



In [60]:
```
ftse_100_final_return = ftse_100['Investment_Return'].iloc[-1]
ftse_250_final_return = ftse_250['Investment_Return'].iloc[-1]
```

In [61]:
```
ftse_100.dropna(inplace=True)
ftse_250.dropna(inplace=True)
```

In [62]:
```
print("Final Investment Return for FTSE 100: £{:.2f}".format(ftse_100_fin
```

```
Final Investment Return for FTSE 100: £120214.26
```

In [63]:
```
print("Final Investment Return for FTSE 250: £{:.2f}".format(ftse_250_fin
```

```
Final Investment Return for FTSE 250: £139917.67
```