44-44-44-64-6-beta-10.85-twist-1

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[2]:
```
%load_ext autoreload
%autoreload 2
from modules import read_and_write
from modules import polyakov
from modules import utility
from modules import fourier_surface
from modules import surface_amplitudes as sf

import pandas as pd
import numpy as np
import os
import glob
```

For reference with integration method the following surface tensions were computed

z_1: $\alpha_{o-o}/T^3(\beta = 10.85) = 1.2316804724774406$

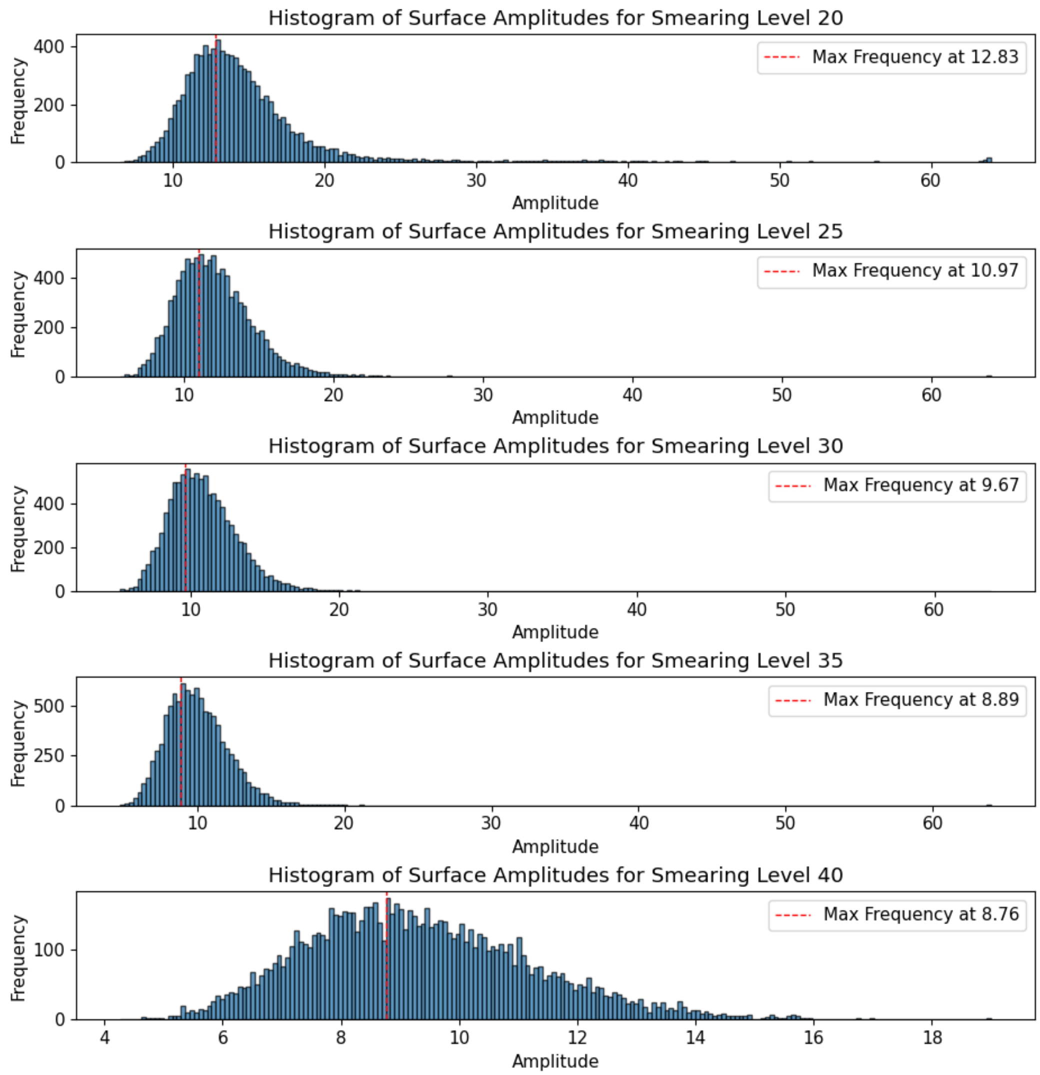
z_2: $\alpha_{o-o}/T^3(\beta = 10.85) = 1.5433288477348852$

1 Load data

[21]:
```
from modules.globals import folder_names
choose_folder = 5
smooth_surfaces = {}
folder = folder_names[choose_folder-1]
files = glob.glob(os.path.join(folder, "surface_smooth_*"))
for file in files:
    file_name = file.split("/")[-1]
    smearing_level = file_name.split("_")[-1]
    volume, fourier_profile = read_and_write.read_surface_data(folder,␣
 ↪file_name)
    smooth_surfaces[smearing_level] = fourier_profile
smooth_surfaces = dict(sorted(smooth_surfaces.items(), key=lambda item:␣
 ↪int(item[0])))
```

[22]:
```
indices = sf.
 ↪surface_amplitudes(smooth_surfaces=smooth_surfaces,return_threshold=None,plot_histogram=Tru
```

```
Smearing Level: 20
Smearing Level: 25
Smearing Level: 30
Smearing Level: 35
Smearing Level: 40
```




```
{'20': (14.939505616658787, 6.517199999999995, 63.950500000000005), '25':
(12.130638336172728, 5.729300000000002, 63.9782), '30': (10.834020263838385,
5.273299999999992, 63.8391), '35': (9.982920551072727, 4.741500000000002,
63.9828), '40': (9.343101475552524, 4.264499999999998, 19.004799999999996)}
```

[76]:
```
from modules.globals import folder_names
```

```
choose_folder = 8
fourier_profiles = {}
folder = folder_names[choose_folder-1]
files = glob.glob(os.path.join(folder, "fourier_profile_*"))
for file in files:
    file_name = file.split("/")[-1]
    smearing_level = file_name.split("_")[-1]
    volume, modes, fourier_profile = read_and_write.
 ↪read_fourier_profile(folder,file_name=file_name)
    fourier_profiles[smearing_level] = fourier_profile
fourier_profiles = dict(sorted(fourier_profiles.items(), key=lambda item:␣
 ↪int(item[0])))
utility.display_markdown_title(folder)
```

2 SU(4), $V = [‘44’, ‘44’, ‘64’, ‘6’]$, $\beta = 10.85$, twist coeff $= 1$

2.1 Perform post processing

[77]:
```
f_n_list = []
errors_list = []
for smearing_level, profile in fourier_profiles.items():
    if indices is not None:
        sample_size = len(profile)
        indices_set = indices[smearing_level]
        profile = np.delete(profile, list(indices_set), axis=0)
        print(f"Dropped {sample_size-len(profile)} samples")
    f_n, errors = utility.compute_with_aa_jackknife_fourier(profile, 10,␣
 ↪thermalization=100)
    f_n_list.append(f_n)
    errors_list.append(errors)
np.array(f_n_list)
np.array(errors_list)
```

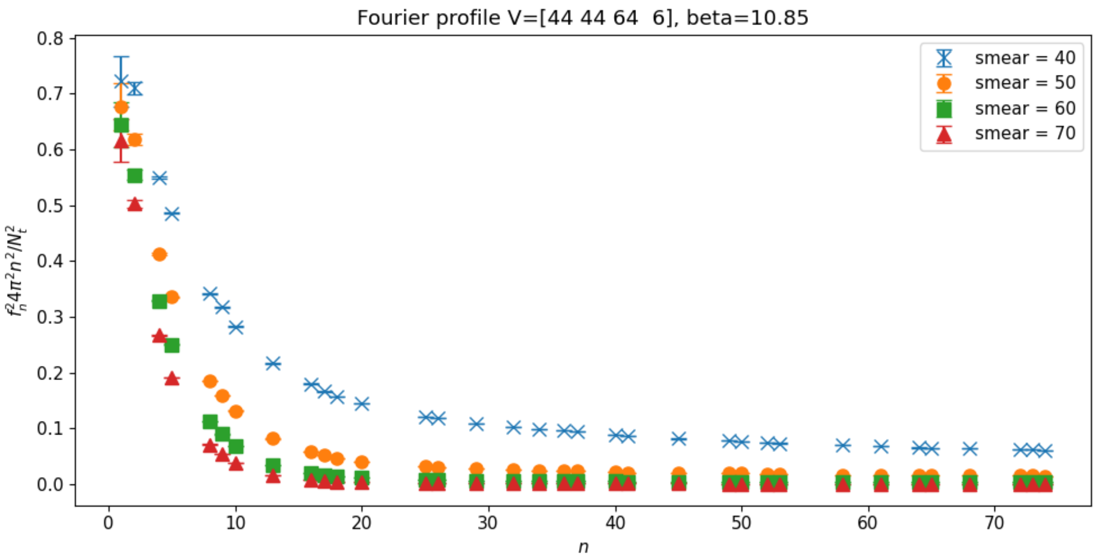
```
(10000, 35)
(10000, 35)
(10000, 35)
(10000, 35)
(4, 35)
```

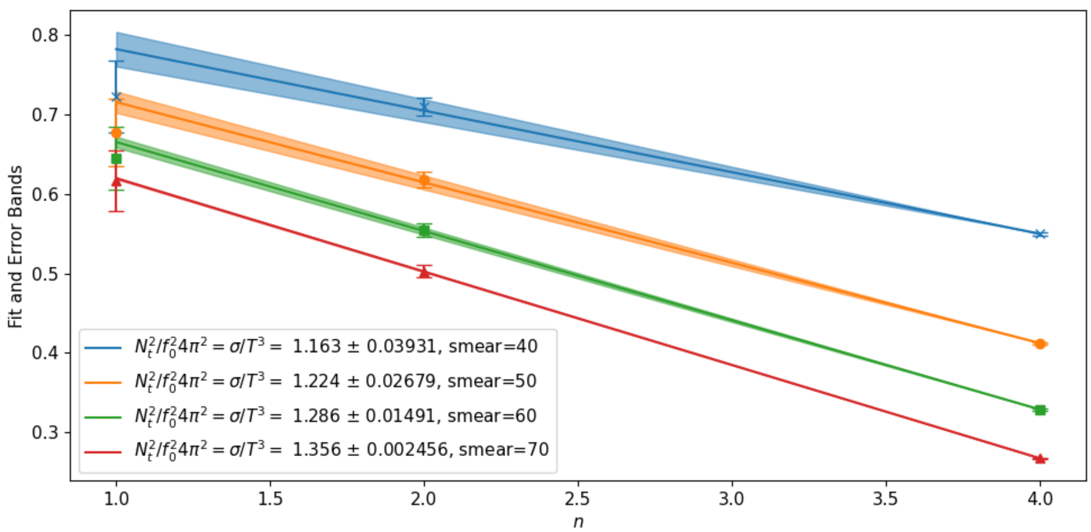
2.2 Plot Fourier modes for different smearing steps

[78]:
```
%matplotlib widget
smearing_levels = list(fourier_profiles.keys())
show_plot = True
data = {
    "smearing": smearing_levels,
```

```
    "linear": [
        fourier_surface.compute_fourier_profile(
            modes, f_n, volume, errors=error, beta=10.85, fit_range=3,␣
↪smearing=smear, show_plot=show_plot
        ) for f_n, error, smear in zip( f_n_list, errors_list, smearing_levels)
    ]
    # "exponential": [
    #     fourier_surface.compute_fourier_profile_exponential_fit(
    #         n_2, f_n, volume, errors=error, beta=10.85, smearing=smear,␣
↪show_plot=show_plot
    #     ) for n_2, f_n, error, smear in zip(n_2_list, f_n_list, errors_list,␣
↪smearing_levels)
    # ]
}
df = pd.DataFrame(data)
utility.print_df_as_markdown_fourier_modes(df)
fourier_surface.global_fig = None
```

smearing	Linear fit (σ/T^3)
40	1.163 ± 0.03931
50	1.224 ± 0.02679
60	1.286 ± 0.01491
70	1.356 ± 0.002456


Fourier profile V=[44 44 64 6], beta=10.85
$f_n^2 4\pi^2 n^2 / N_t^2$
n
smear = 40
smear = 50
smear = 60
smear = 70


Fit and Error Bands
n
$N_t^2/f_0^2 4\pi^2 = \sigma/T^3 =$ 1.163 ± 0.03931, smear=40
$N_t^2/f_0^2 4\pi^2 = \sigma/T^3 =$ 1.224 ± 0.02679, smear=50
$N_t^2/f_0^2 4\pi^2 = \sigma/T^3 =$ 1.286 ± 0.01491, smear=60
$N_t^2/f_0^2 4\pi^2 = \sigma/T^3 =$ 1.356 ± 0.002456, smear=70

[ ]: