60-60-86-6-beta-10.82-twist-2

November 4, 2024

[65]:
```
%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
from modules import globals
import pandas as pd
import numpy as np
import os
import glob
indices = None
surface_tension_dict = {}
```

```
The autoreload extension is already loaded. To reload it, use:
  %reload_ext autoreload
```

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

[66]:
```
folders = utility.list_all_folders(globals.data_path,"60-60-86-6")
```

```
../data/output-measure-surface/su4-60-60-86-6/beta-10.80-twist-1-60-60-86-6 ,
index: 0
../data/output-measure-surface/su4-60-60-86-6/beta-10.80-twist-2-60-60-86-6 ,
index: 1
../data/output-measure-surface/su4-60-60-86-6/beta-10.82-twist-1-60-60-86-6 ,
index: 2
../data/output-measure-surface/su4-60-60-86-6/beta-10.82-twist-2-60-60-86-6 ,
index: 3
../data/output-measure-surface/su4-60-60-86-6/beta-10.83-twist-1-60-60-86-6 ,
index: 4
../data/output-measure-surface/su4-60-60-86-6/beta-10.85-twist-1-60-60-86-6 ,
```

```
index: 5
../data/output-measure-surface/su4-60-60-86-6/beta-10.85-twist-2-60-60-86-6 ,
index: 6
../data/output-measure-surface/su4-60-60-86-6/beta-11.5-twist-1-60-60-86-6 ,
index: 7
../data/output-measure-surface/su4-60-60-86-6/beta-11.5-twist-2-60-60-86-6 ,
index: 8
```

[78]:
```
choose_folder = 3
fourier_profiles = {}
folder = folders[choose_folder]
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 = ['60', '60', '86', '6'], β = 10.82, twist coeff = 2

2.1 Perform post processing

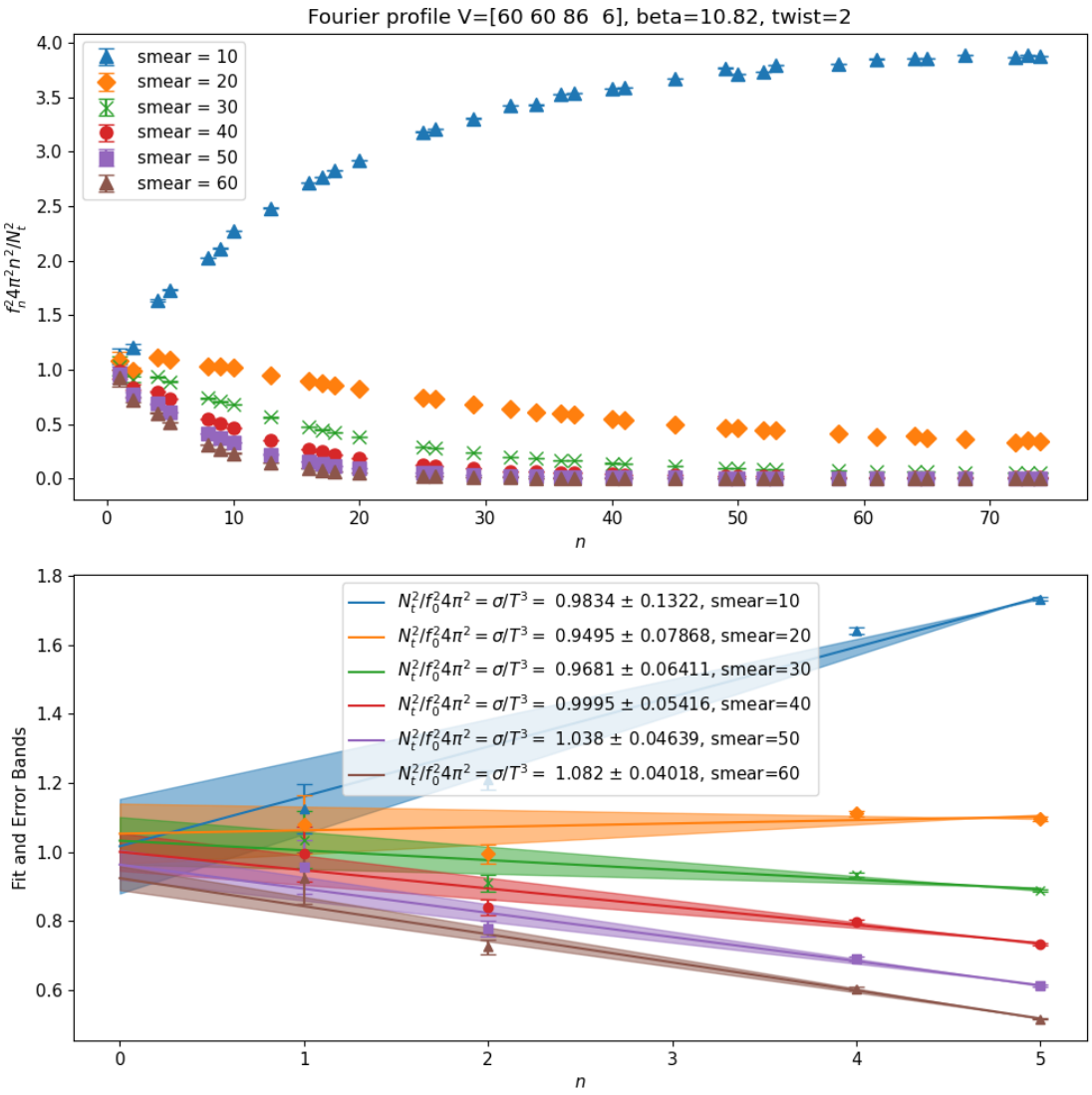
[79]:
```
f_n_list = []
errors_list = []
for smearing_level, profile in fourier_profiles.items():
    if indices is not None:
        sample_size = len(profile)
        indices_set = indices[smearing_level]
        profile = np.delete(profile, list(indices_set), axis=0)
        print(f"Dropped {sample_size-len(profile)} samples")
    f_n, errors = utility.compute_with_aa_jackknife_fourier(profile, 10,␣
 ↪thermalization=1000)
    f_n_list.append(f_n)
    errors_list.append(errors)
```

2.2 Plot Fourier modes for different smearing steps

[80]:
```
%matplotlib widget
smearing_levels = list(fourier_profiles.keys())
show_plot = True
twist = folder.split("/")[4].split('-')[3]
temp = folder.split("/")[4].split('-')[1]
```

```
data = {
    "smearing": smearing_levels,
    "linear": [
        fourier_surface.compute_fourier_profile(
            modes, f_n, volume, errors=error, beta=temp, twist=twist,␣
 ↪fit_range=4, 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)
    # ]
}
surface_tension_dict[folder.split("/")[-1]] = data
df = pd.DataFrame(data)
utility.print_df_as_markdown_fourier_modes(df)
fourier_surface.global_fig = None
```

smearing	Linear fit (σ/T^3)
10	0.9834 ± 0.1322
20	0.9495 ± 0.07868
30	0.9681 ± 0.06411
40	0.9995 ± 0.05416
50	1.038 ± 0.04639
60	1.082 ± 0.04018


Fourier profile V=[60 60 86 6], beta=10.82, twist=2
smear = 10
smear = 20
smear = 30
smear = 40
smear = 50
smear = 60
$f_n^2 4\pi^2 n^2/N_t^2$
n
$N_t^2/f_0^2 4\pi^2 = \sigma/T^3 =$ 0.9834 ± 0.1322, smear=10
$N_t^2/f_0^2 4\pi^2 = \sigma/T^3 =$ 0.9495 ± 0.07868, smear=20
$N_t^2/f_0^2 4\pi^2 = \sigma/T^3 =$ 0.9681 ± 0.06411, smear=30
$N_t^2/f_0^2 4\pi^2 = \sigma/T^3 =$ 0.9995 ± 0.05416, smear=40
$N_t^2/f_0^2 4\pi^2 = \sigma/T^3 =$ 1.038 ± 0.04639, smear=50
$N_t^2/f_0^2 4\pi^2 = \sigma/T^3 =$ 1.082 ± 0.04018, smear=60
Fit and Error Bands
n

[ ]: