Documentation of Python Files

Your Name

July 26, 2024

Contents

1 Introduction

This document provides detailed documentation for a collection of Python scripts. It includes information on how to run each script, the arguments they accept, and the purpose of each argument.

2 Python Script Overview

- `gen_smf_1d.py`
- `calc_area_of_ft_data.py`
- `calc_legett_at_t.py`
- `calc_oscill_period_at_t.py`
- `fourier_utils.py`
- `gen_smf_2d.py`
- `plot_density_evolution_at_t.py`
- `plot_density_evolution_at_x.py`
- `plot_ft_at_t.py`
- `plot_ft_at_x.py`
- `plot_intensity_2d.py`
- `plot_intensity.py`
- `plot_spatial_analysis_graphs_changing_p0.py`
- `plot_spatial_ft_graphs_changing_p0.py`
- `plot_temporal_analysis_graphs_changing_p0_at_x.py`
- `plot_temporal_ft_graphs_changing_p0_at_x.py`
- `snapshots1d_bec_intens.py`
- `standard_data_utils.py`

3 Detailed Script Documentation

3.1 gen_smf_1d.py

- **Description:** Generates a new $|\psi|^2$ dataset with one spatial dimension and one time dimension given some input parameters and arguments.
- **Prerequisites:**
  - Create a folder in `/patt1d_inputs` titled with the name of the dataset (can be named whatever you choose).
  - In this folder, you must have a file named `seed.in` which contains all of the initial values used to generate the dataset.
- **Usage:** `python gen_smf_1d.py -f <file name> -n <number of frames> -s <start p0> -e <end p0>`
- **Arguments:**
  - `-f` (required): The name of the file, which is the same name as the folder in `patt1d_inputs`.
  - `-n` (required): The number of frames/generated data with different p_0 values. If more than 1 is input, then you will have to specify the start and end p_0 values.
  - `-s` (required): The starting p_0 value to generate data for.
  - `-e` (required): The ending p_0 value to generate data for.
- **Output:**
  - A new folder with the inputted filename in `/patt1d_outputs`.
  - In this folder will be n `psi*.out` and `s*.out` files where n is the inputted `-n` argument.
  - If n is greater than 1, then the `psi` and `s` filenames will be formatted to have an index followed by the p_0 value at that index.
- **Next Steps:** Once this data is obtained, all of the other Python scripts can be used to analyze this data.

3.2 calc_area_of_ft_data.py

- **Description:** Calculates the area of FT data.
- **Usage:** `python calc_area_of_ft_data.py -f <filename> -x <x_position> -s <starting_frequency_position> -e <ending_frequency_position> [-i <frame_index>]`
- **Arguments:**

- `-f`, `--filename` (required): The name of the file to save to.
- `-x`, `--xpos` (required): The x coordinate to inspect the Fourier transform at.
- `-s`, `--start_f` (required): The starting frequency limit of integration.
- `-e`, `--end_f` (required): The ending frequency limit of integration.
- `-i`, `--frame_index` (optional): The index of the frame to plot.

3.3 `calc_legett_at_t.py`

- **Description:** Calculates Leggett at time t.
- **Usage:** `python calc_legett_at_t.py -f <filename> -t <time> [-i <frame_index>]`
- **Arguments:**
  - `-f`, `--filename` (required): The name of the file to save to.
  - `-t`, `--time` (required): The time to inspect the amplitude evolution at.
  - `-i`, `--frame_index` (optional): The index of the frame to plot.

3.4 `calc_oscill_period_at_t.py`

- **Description:** Calculates the oscillation period at time t.
- **Usage:** `python calc_oscill_period_at_t.py -f <filename> -t <time> [-i <frame_index>]`
- **Arguments:**
  - `-f`, `--filename` (required): The name of the file to save to.
  - `-t`, `--time` (required): The time to inspect the amplitude evolution at.
  - `-i`, `--frame_index` (optional): The index of the frame to plot.

3.5 `fourier_utils.py`

- **Description:** Utility functions for Fourier transforms.
- **Usage:** This file is not intended to be run directly. It contains functions used by other scripts.

3.6 gen_smf_2d.py

- **Description:** Generates 2D SMF data.
- **Usage:**
- **Arguments:**
  –

3.7 plot_density_evolution_at_t.py

- **Description:** Plots density evolution over time.
- **Usage:** `python plot_density_evolution_at_t.py -f <filename> -t <time> [-i <index>]`
- **Arguments:**
  – `-f`, `--filename` (required): The name of the file to save to.
  – `-t`, `--time` (required): The time to inspect the amplitude evolution at.
  – `-i`, `--index` (optional): The index of the frame to plot.

3.8 plot_density_evolution_at_x.py

- **Description:** Plots density evolution at a specific x position.
- **Usage:** `python plot_density_evolution_at_x.py -f <filename> -x <xpos> [-i <frame_index>] -t <trail_x_max>`
- **Arguments:**
  – `-f`, `--filename` (required): The name of the file to save to.
  – `-x`, `--xpos` (required): The x-position coordinate to inspect the amplitude evolution at.
  – `-i`, `--frame_index` (optional): The index of the frame to plot.
  – `-t`, `--trail_x_max` (required): Specifies whether to follow the peaks that start at the required x position (`True` or `False`).

3.9 plot_ft_at_t.py

- **Description:** Analyzes PATT1D output data at a specific time.
- **Usage:** `python plot_ft_at_t.py -f <filename> -t <time> [-i <frame_index>]`
- **Arguments:**
  – `-f`, `--filename` (required): The name of the file to save to.

- `-t`, `--time` (required): The time to inspect the amplitude evolution at.
- `-i`, `--frame_index` (optional): The index of the frame to plot.

3.10 plot_ft_at_x.py

- **Description:** Analyzes PATT1D output data at a specific x position.
- **Usage:** `python plot_ft_at_x.py -f <filename> -x <xpos> [-i <frame_index>]`
- **Arguments:**
  - `-f`, `--filename` (required): The name of the file to save to.
  - `-x`, `--xpos` (required): The x coordinate to inspect the Fourier transform at.
  - `-i`, `--frame_index` (optional): The index of the frame to plot.

3.11 plot_intensity.py

- **Description:** Plots PSI and S data from simulation outputs.
- **Usage:** `python plot_intensity.py -f <filename> [-i <frame_index>]`
- **Arguments:**
  - `-f`, `--filename` (required): The name of the file to save to.
  - `-i`, `--frame_index` (optional): The index of the frame to plot.

3.12 plot_spatial_analysis_graphs_changing_p0.py

- **Description:** Analyzes and plots data from PATT1D outputs.
- **Usage:** `python plot_spatial_analysis_graphs_changing_p0.py -f <filename>`
- **Arguments:**
  - `-f`, `--filename` (required): The name of the file to save to.

3.13 plot_spatial_ft_graphs_changing_p0.py

- **Description:** Data analysis for 1D pattern formation.
- **Usage:** `python plot_spatial_ft_graphs_changing_p0.py -f <filename>`
- **Arguments:**
  - `-f`, `--filename` (required): The name of the file to save to.

3.14 plot_temporal_analysis_graphs_changing_p0_at_x.py

- **Description:** Analyzes temporal statistics of PATT1D outputs.
- **Usage:** `python plot_temporal_analysis_graphs_changing_p0_at_x.py -f <filename> -x <xpos>`
- **Arguments:**
  - `-f`, `--filename` (required): The name of the file to save to.
  - `-x`, `--xpos` (required): The x coordinate to inspect the temporal statistics at.

3.15 plot_temporal_ft_graphs_changing_p0_at_x.py

- **Description:** Analyzes Fourier transforms of PATT1D outputs.
- **Usage:** `python plot_temporal_ft_graphs_changing_p0_at_x.py -f <filename> -x <xpos>`
- **Arguments:**
  - `-f`, `--filename` (required): The name of the file to save to.
  - `-x`, `--xpos` (required): The x coordinate to inspect the Fourier transform at.

3.16 snapshots1d_bec_intens.py

- **Description:** Generates snapshots of 1D BEC intensity.
- **Usage:** `python snapshots1d_bec_intens.py -f <filename>`
- **Arguments:**
  - `-f`, `--filename` (required): The name of the file to save to.

3.17 standard_data_utils.py

- **Description:** Standard utility functions for data manipulation.
- **Usage:** This file is not intended to be run directly. It contains functions used by other scripts.