

GalSim Library Quick Reference

1. Overview

BARNEY TODO: Tidy this whole thing up, make it look a lot less ugly, maybe use an entirely different document class.

The GalSim Library provides a number of Python classes and methods for simulating astronomical images. The fundamental work flow will normally be something like:

- Construct a representation of your desired astronomical object as a single GalSim `GSObject` instance or in combination using the special `Add` and `Convolve` compound-type `GSObjects` — see Section 2.
- *Optional:* Apply transformations such as shear or magnification using the methods of the resulting `GSObject` instance — see Section 2.
- Draw the object into a GalSim `Image` object representing a postage stamp image of your astronomical object. This can be done using the `draw()` or `drawShoot()` methods carried by all `GSObjects` for rendering images (`drawShoot` uses photon shooting) — see Section 2.
- *Optional:* Add noise to the `Image` using one of the GalSim random deviate classes — see Section 3.
- *Optional:* Add the postage stamp `Image` to a subsection of a larger `Image` instance, or to a larger structure containing multiple `Image` instances each derived from `GSObjects` as described above — see Section 4.
- Save the `Image(s)` to file in FITS (Flexible Image Transport System) format — see Section 4.

There are many examples of this workflow in the directory `GalSim/examples/`, in the example scripts `BasicDemo.py`, `MultiObjectDemo.py` and `RealDemo.py`. We now provide a brief, reference description of the GalSim classes and methods which can be used in this workflow.

2. GSOBJECT classes and methods

2.1. Lists of available GSOBJECTS

There are currently 12 types of `GSOBJECT`. The first ten listed are ‘simple’ or ‘atomic’ `GSOBJECTS` that can be initialized by providing values for their required or optional parameters; the last two are ‘compound’ classes used to represent combinations of `GSOBJECTS`. In the order in which the classes appear in `GalSim/galsim/base.py`:

- `Gaussian` — a 2D Gaussian profile.
- `Moffat` — a Moffat profile, used to approximate PSFs.
- `AtmosphericPSF` — currently an image-based implementation of a Kolmogorov PSF (see below), but expected to evolve to use an image of a stochastically modelled atmospheric PSF in the near future.
- `Airy` — an Airy PSF for ideal diffraction through a circular aperture, supports central obscuration.
- `Kolmogorov` — the Kolmogorov PSF for long-exposure images through a turbulent atmosphere.
- `OpticalPSF` — a simple model for non-ideal (aberrated) propagation through circular or square apertures with obscuration.
- `Pixel` — used for integrating light onto square or rectangular pixels.
- `Sersic` — the Sérsic family of galaxy light profiles.
- `Exponential` — the Exponential disc, a Sérsic with index $n = 1$.
- `DeVaucouleurs` — commonly used to model galaxy bulge profiles, a Sérsic with index $n = 4$.
- `RealGalaxy` — models galaxies using real data, including correction for the original PSF.
- `Add` — a *compound* object used for summing multiple `GSOBJECTS`.
- `Convolve` — a *compound* object used for convolving multiple `GSOBJECTS`.

For more info and initialization details for each `GSOBJECT`, type `print galsim.<GSOBJECT_name>.__doc__` within the Python interpreter.

2.2. GSOBJECT methods

3. Random deviate classes and methods

4. Image classes and methods