Performing Elliptical Isophote Analysis with Photutils on Barred GalaxyZoo 3D Masks from SDSS-IV MaNGA Galaxies

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Galactic Bars

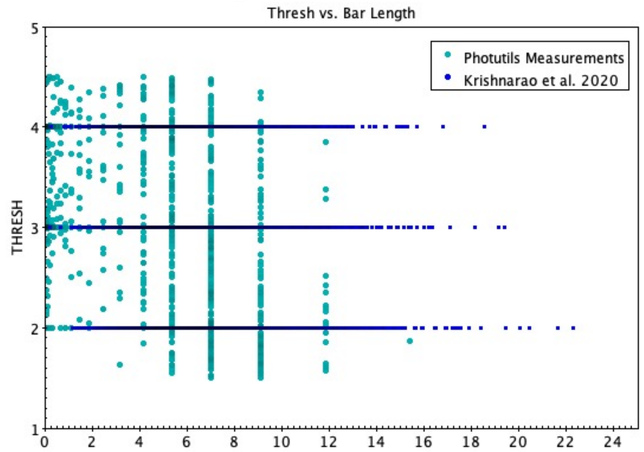
Galactic bars are extended **linear** structures crossing the center of a substantial fraction of disc galaxies (Masters et al. 2011).
The **length** and **axis ratio** of bars are useful quantities to measure their strength.
Previous works have used different methods to measure these bar dimensions, such as using interactive and **robust crowd-sourcing interfaces** (Hoyle et al. 2011), **Fourier analysis** (Elmegreen & Elmegreen 1985) and **elliptical Petrosian photometric analysis** (Krishnarao et al. 2020).

Methodology

We make use of Galaxy Zoo: 3D (Masters et al. 2021), a Galaxy Zoo style analysis which identifies in detail the locations of internal structures of galaxies targeted by Mapping Nearby Galaxies at Apache Point Observatory (**MaNGA**), an optical fiber-bundle integral-field unit (IFU) spectroscopic survey that is one of three core programs in the fourth-generation Sloan Digital Sky Survey (**SDSS-IV**). We perform **elliptical isophote analysis** with **Photutils** on the crowd-sourced bar masks from GZ3D.

Results

Out of the 656 successful outputs, we select a **threshold/intensity** level **closest to 3.0**, similar to Krishnarao et al. (2020) to represent the samples' **measured bar lengths.**



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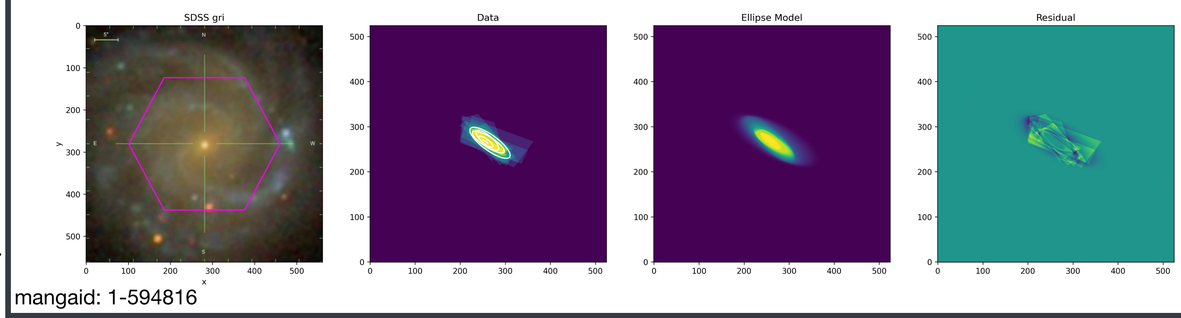
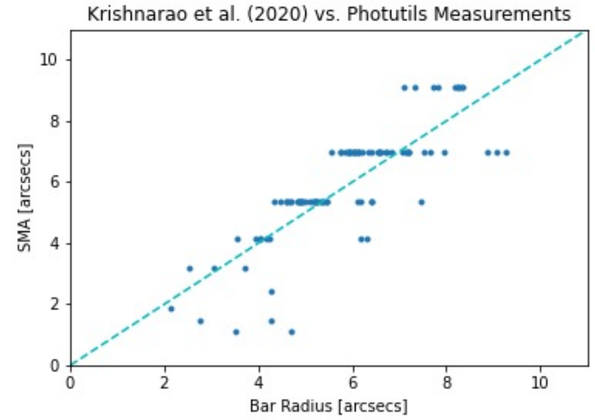
Performing **elliptical isophote analysis** with **Photutils** on **GZ3D bar masks** is relatively **accurate** and provides a **useful novel** approach to **generate bar dimensions.**



We select a sample of **1,355** barred face-on disc galaxies to test the code with **656** (**48%**) successful outputs.

Results Continued

We show **a one-to-one comparison** between this work's **bar length measurements** with the **elliptical isophote analysis** and Krishnarao et al. (2020) bar length measurements with the **box-bounding method.**



With some scatter, the result presented here is relatively close to one-to-one, meaning the bar measurements of each method are comparable. Thus, **we conclude** that performing elliptical isophote analysis with Photutils on GZ3D bar masks **is relatively accurate** and provides **a useful novel** approach to **generate bar dimensions.**

We aim to continue to make improvements towards this method and make use of this approach to measure bar dimensions in further studies.

Future Works

Our most immediate future work concerns concluding the statistical analysis between comparing this work's bar measurements and Krishnarao et al. (2020) and investigating the failed bar masks data.

Other possible long term scientific goals include:

- Creating radial plots of star formation properties relative to the length and angle of the bar.
- Investigate bar lengths and position angles onto velocity maps.
- Use GZ3D bar masks to find the relative strength of the bar in relation to the length.

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