

# 1 The Concept

## 2 The Model

The model is a simple disk+bulge galaxy, with the following parameters:

- $R_{disk}$ , disk half-light radius
- $F_{disk}$ , disk flux
- $g_1^{disk}$ , disk intrinsic alignment
- $g_2^{disk}$ , disk intrinsic alignment
- $R_{bulge}$ , bulge half-light radius
- $F_{bulge}$ , bulge flux
- $g_1^{bulge}$ , bulge intrinsic alignment
- $g_2^{bulge}$ , bulge intrinsic alignment
- $g_1^{shear}$ , lensing shear
- $g_2^{shear}$ , lensing shear
- $\mu$ , lensing magnification (this parameter is optional)

$g_1^{disk}$ ,  $g_2^{disk}$ ,  $g_1^{bulge}$ , and  $g_2^{shear}$  all model intrinsic alignment, but are parameterized like reduced shear in weak lensing formalism because it's easy to apply with galsim. The bulge is drawn with a De Vaucouleurs profile, and the disk is drawn with an  $n = 1$  Sersic profile. The image is convolved with a  $\sigma = 0.25$  arcsecond Gaussian PSF.

One important aspect of the model is that the disk and bulge can optionally be drawn with different  $r - g$  colors such that  $(g - r)_{disk} \approx (g - r)_{bulge} - 2$ . (n.b. I have to check to ensure that these magnitudes are being calculated correctly.) We have been treating the color difference between the disk and bulge like a prior in that we are interested in how much switching it on affects our fits, but our current treatment presumes perfect knowledge of the color difference between disk and bulge.

## 3 Priors

Besides the “prior” on disk and bulge color, we are applying two empirically motivated priors.

### 3.1 The Kormendy Relation

The Kormendy relation essentially a projection of the fundamental plane. It states that for elliptical galaxies,  $R_e \propto \langle I \rangle^{0.83}$ . We take, as a prior on the bulge radius and flux, a distribution that is normally distributed around the line in  $\log I - \log R$  space defined by the Kormendy relation.

### 3.2 Orientation Prior

Assuming that the disk and bulge are oriented randomly in 3D space, they take on a non-uniform distribution of inclination angles. By assuming a uniform distribution of 3D orientations, we arrive at a prior proportional to  $g = \sqrt{g_1^2 + g_2^2}$  for the disk and bulge.