Deriving M101 Properties

Surface Brightness and Color Profile

Remember what you did in HW #2 for M84:

- One image (V)
- Binned pixels by radius, got average/median pixel intensity (I_V) as a function of bin radius
- Turned pixel intensity into magnitude using 1-band photometric solution: $m_V = -2.5 \log I_V + 28.60$
- Turned magnitude into surface brightness given the pixel area: $\mu_V = m_V + 2.5 \log(1.45^2)$

For M101 it's a bit different:

- Two images (B, V)
- Bin pixels by radius, get average/median pixel intensity for each image (I_B, I_V) as a function of bin radius
- Turn pixel intensities into magnitude and color using 2-band photometric solution function we worked out in class (Photometry.ipynb on M101 Lab page)

The answer is shown in Mihos et al (2013), so you know what you are aiming for

Deriving M101 Properties

Scale length and central surface brightness

Remember M101 is an exponential disk (linear intensity units): $I(r) = I_0 e^{-r/h}$

Turning this into surface brightness (mag/arcsec^2): $\mu(r) = \mu_0 + \frac{2.5}{h \ln 10} r$

So fit a straight line to your surface brightness profile (decide and explain what radial range is best to do this) and use the fitted slope and intercept to derive μ_0 and h.

Total Magnitude

With your fitted values for μ_0 and h work out total apparent magnitude: $m_{tot} = \mu_0 - 2.5 \log(2\pi h^2)$
(Remember HW #3 from ASTR323....)

Uncertainties

Propogate the errors in slope and zeropoint from your straight line fit to get the uncertainties on your derived parameters.