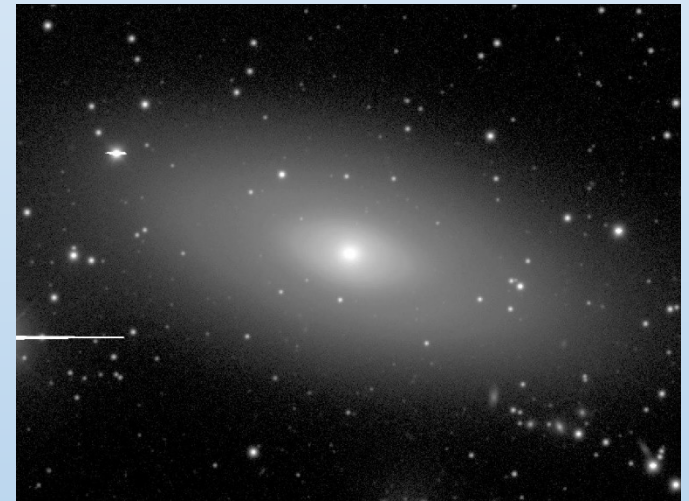
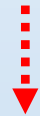
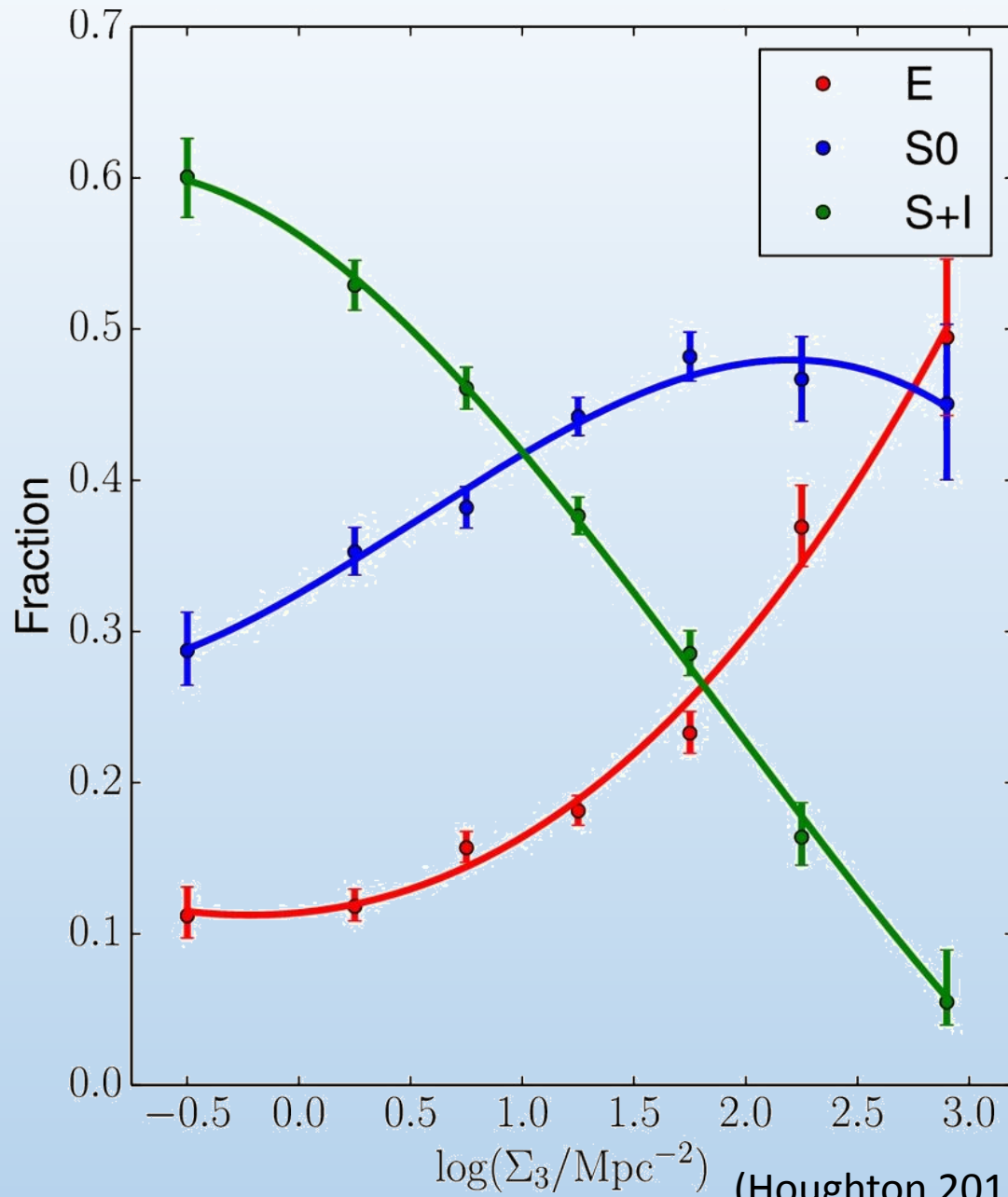


Disentangling the Evolution of S0 Galaxies Using Spectral Data Cubes

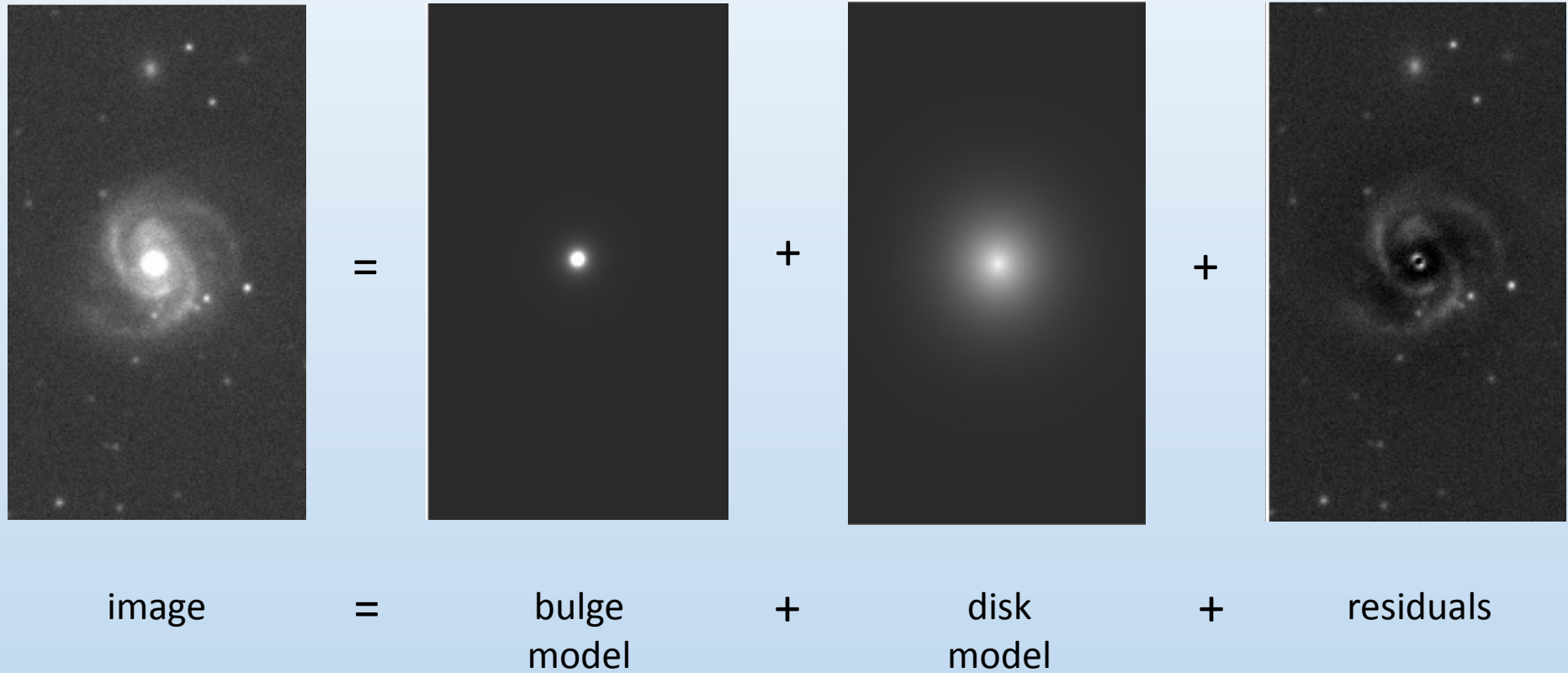
Evelyn Johnston, Martha Tabor,
Michael Merrifield, Alfonso Aragón-Salamanca, Boris
Häussler, Steven Bamford, Michele Cappellari

Morphology – Density Relation

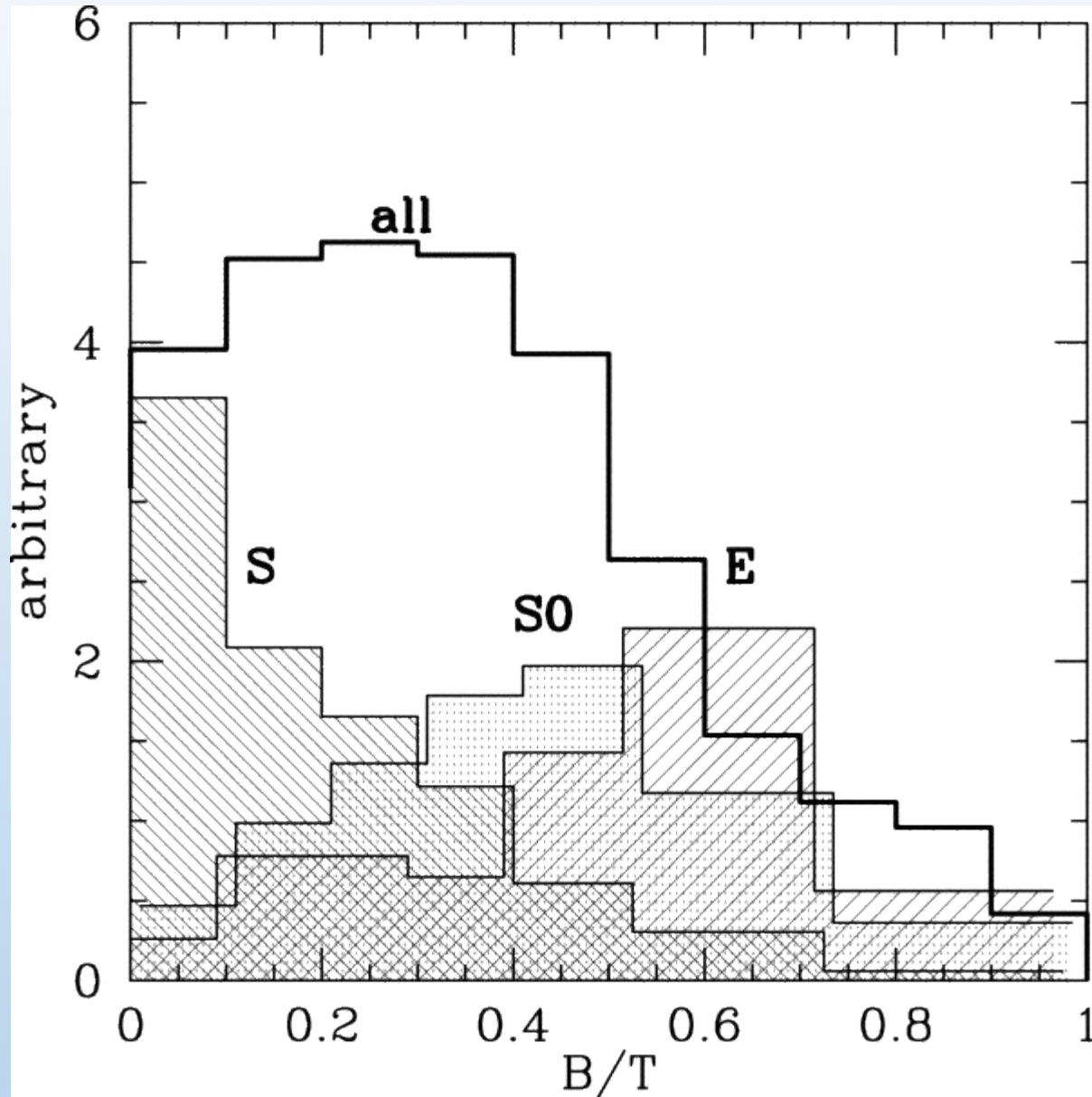


(Houghton 2015, after Dressler 1980)

Photometric Bulge–Disk Decomposition



Bulge-to-Total Ratio by Morphological Type

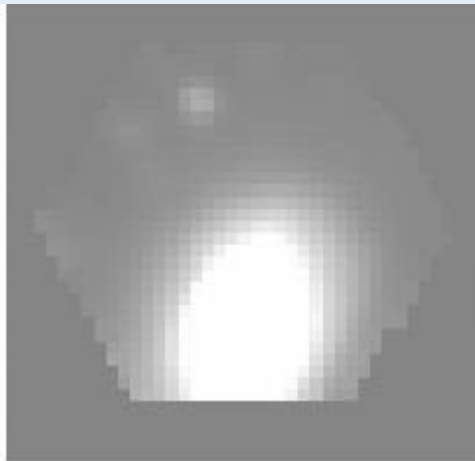


Data Cube Bulge–Disk Decomposition

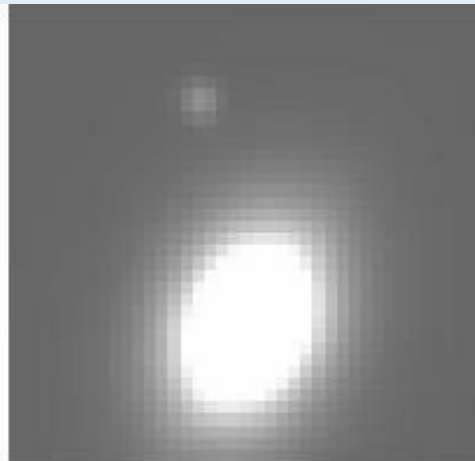
SDSS J152201.79+433156.3



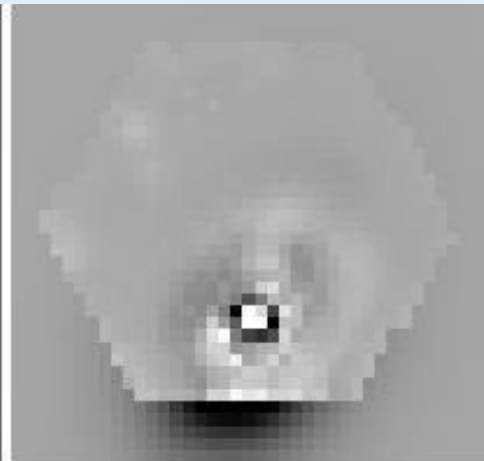
image



data cube
wavelength
slice



model
wavelength
slice



residuals

Data Cube Bulge–Disk Decomposition

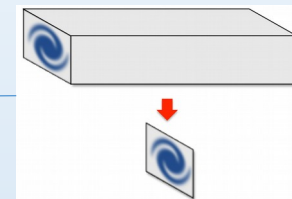
Bin data to
determine kinematics



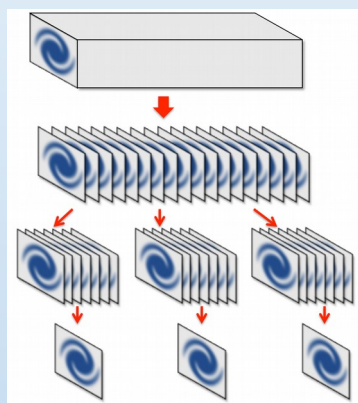
Obliterate
kinematics



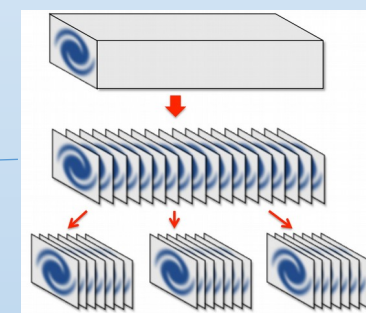
Fit single “broad-band image”
(L_b , L_d , R_d , R_b , n_b , n_d , PA , q , free)



Fit 50 “narrow-band images”
(L_b , L_d free, R_d , R_b , n_b linear, n_d , PA , q held)

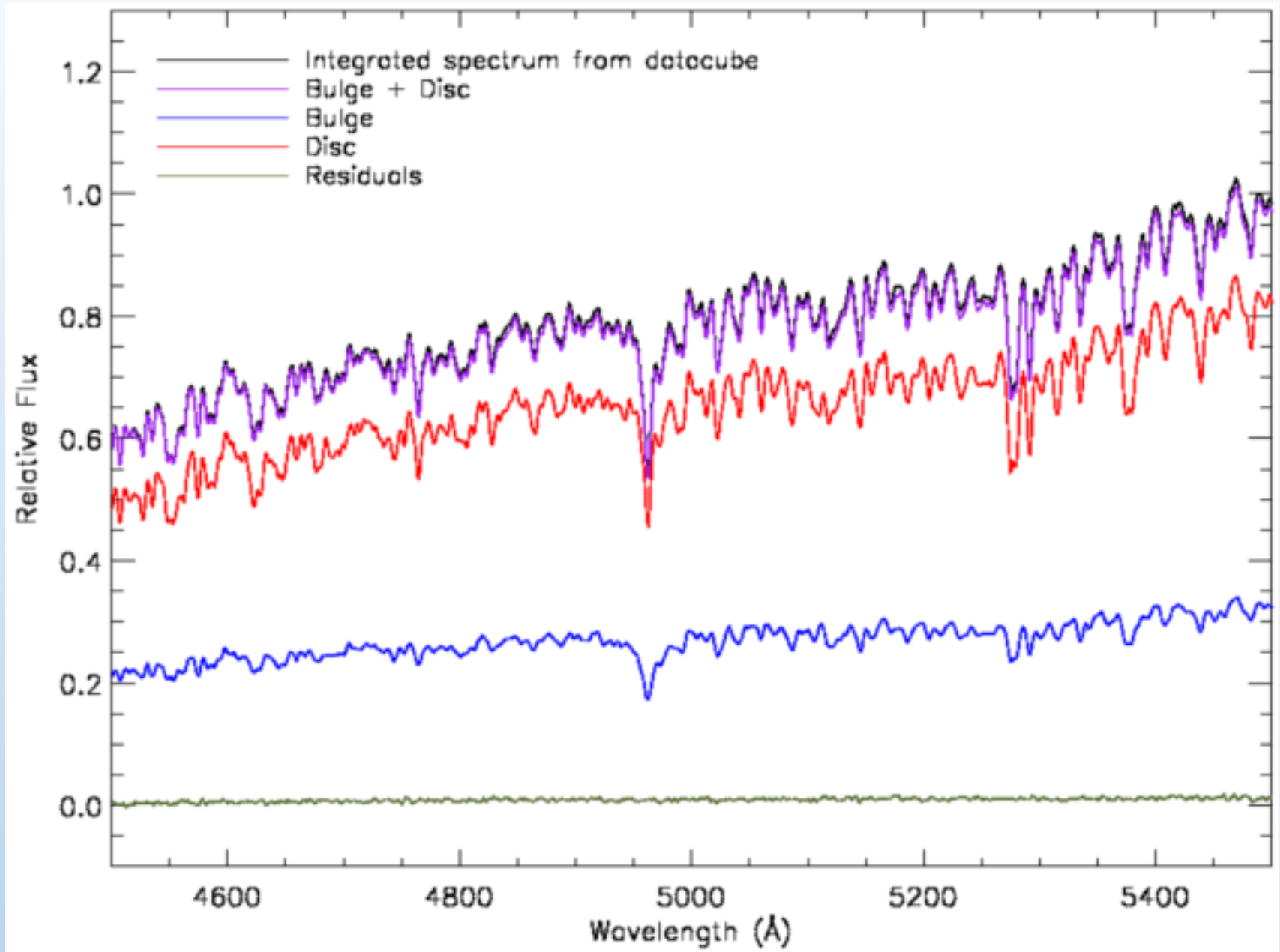


Fit all “rest wavelength slices”
(L_b , L_d free, R_d , R_b , n_b , n_d , PA , q held)



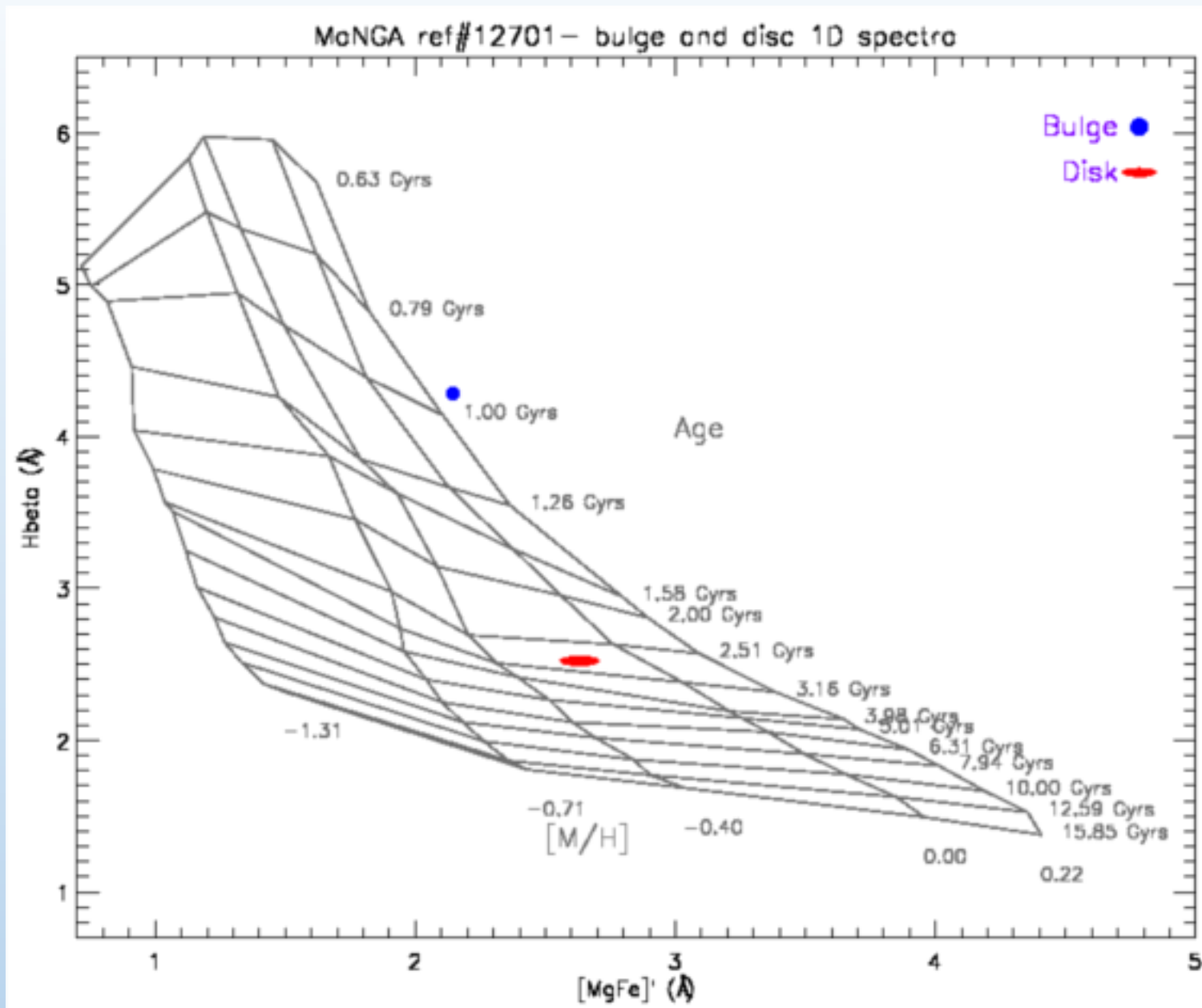
Construct spectra
 $L_b(\lambda)$, $L_d(\lambda)$

SDSS J152201.79+433156.3

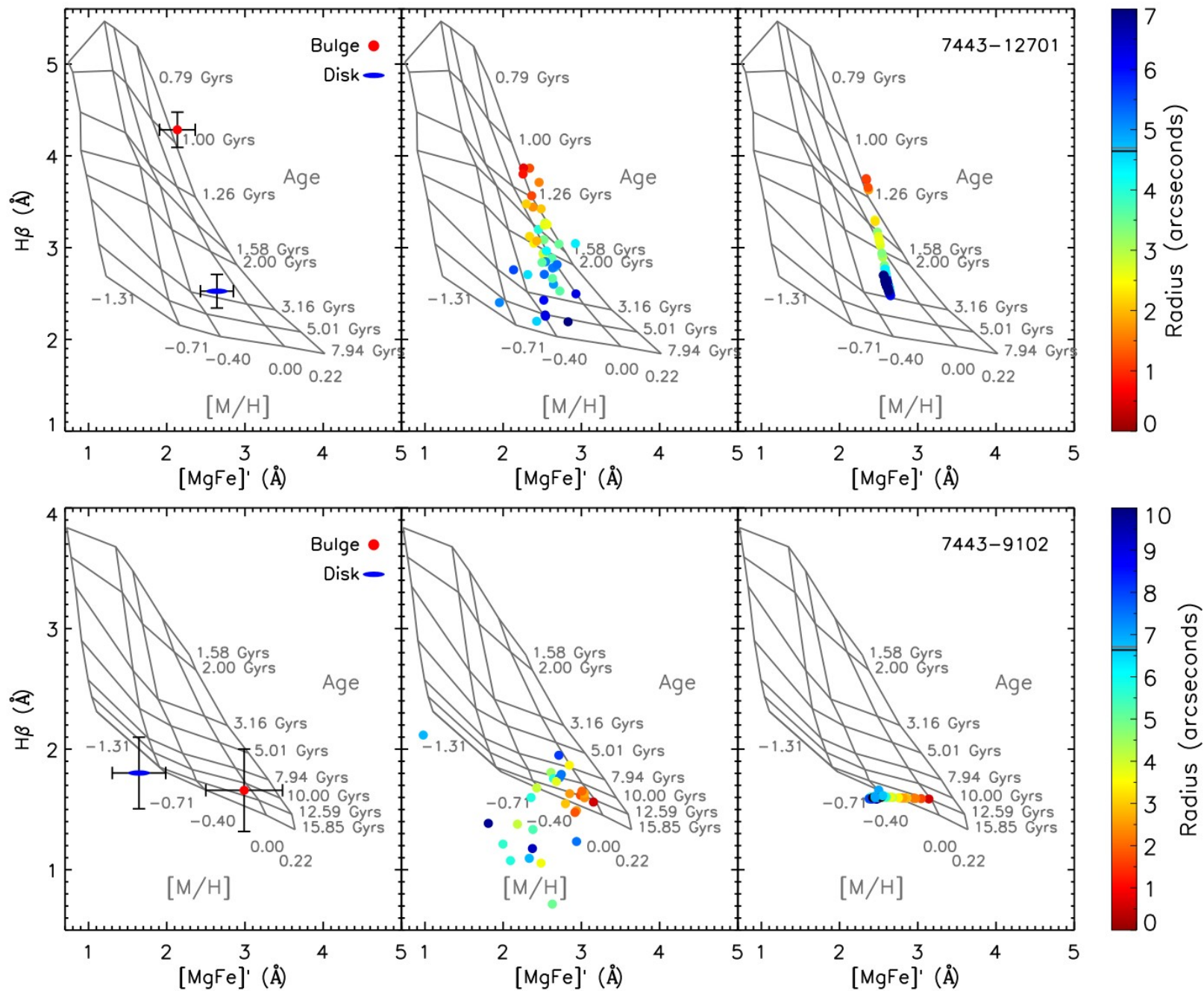


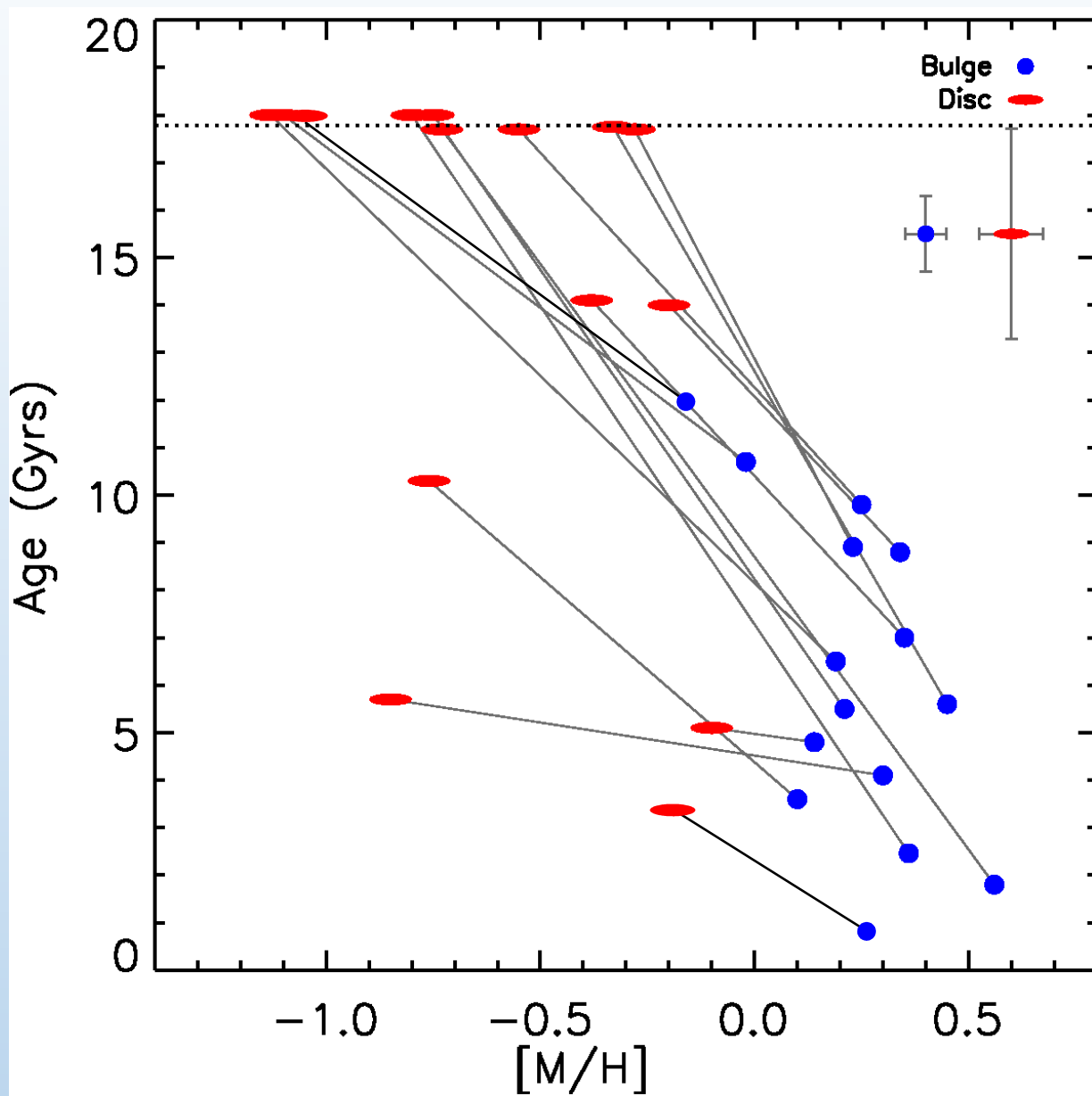
(Johnston *et al.* 2016)

SDSS J152201.79+433156.3



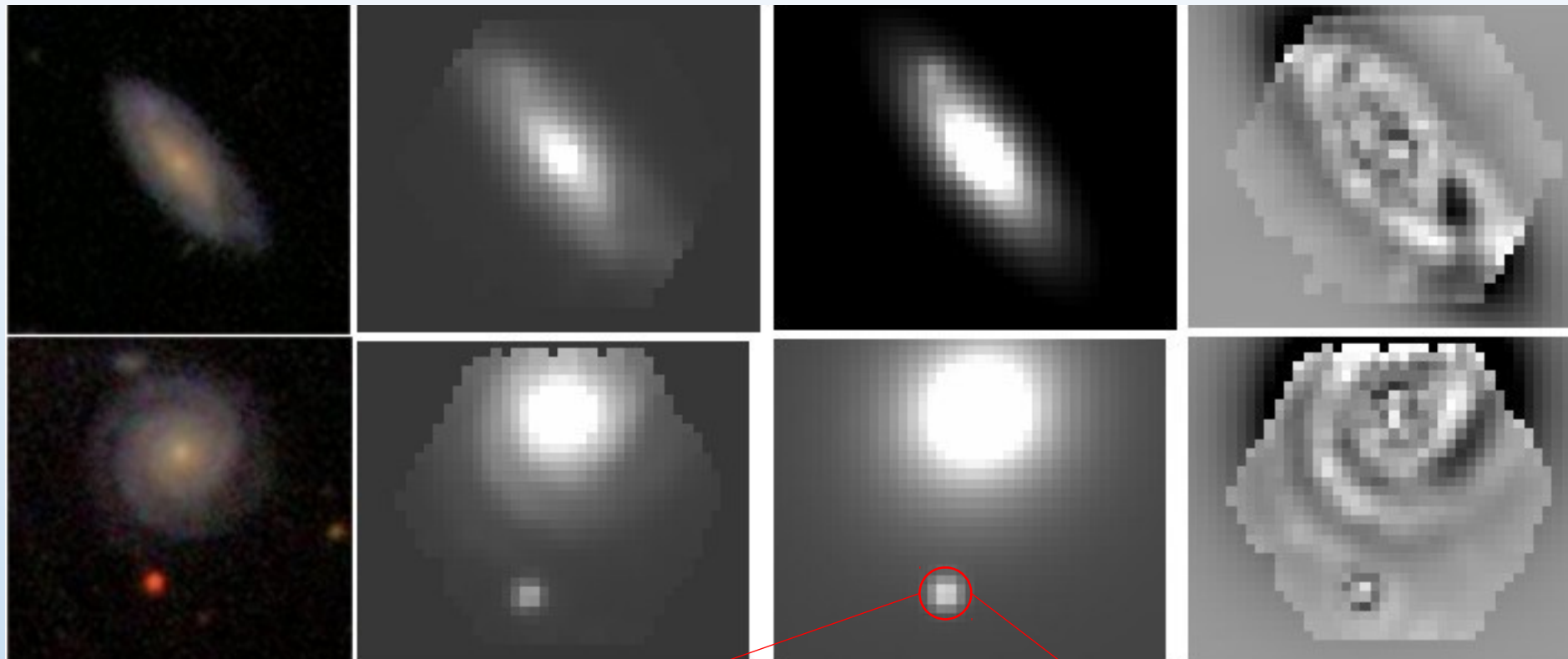
(Johnston *et al.* 2016)



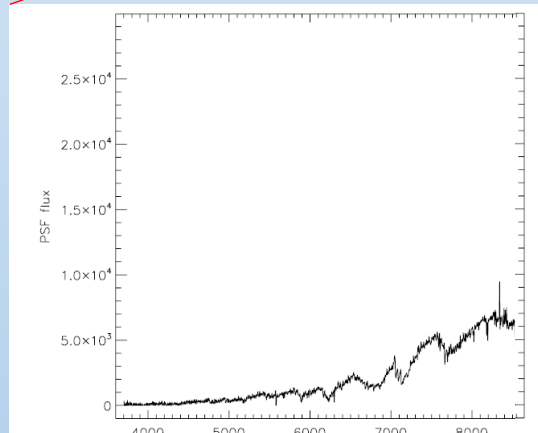


More Components?

SDSS J152036.61+415725.1

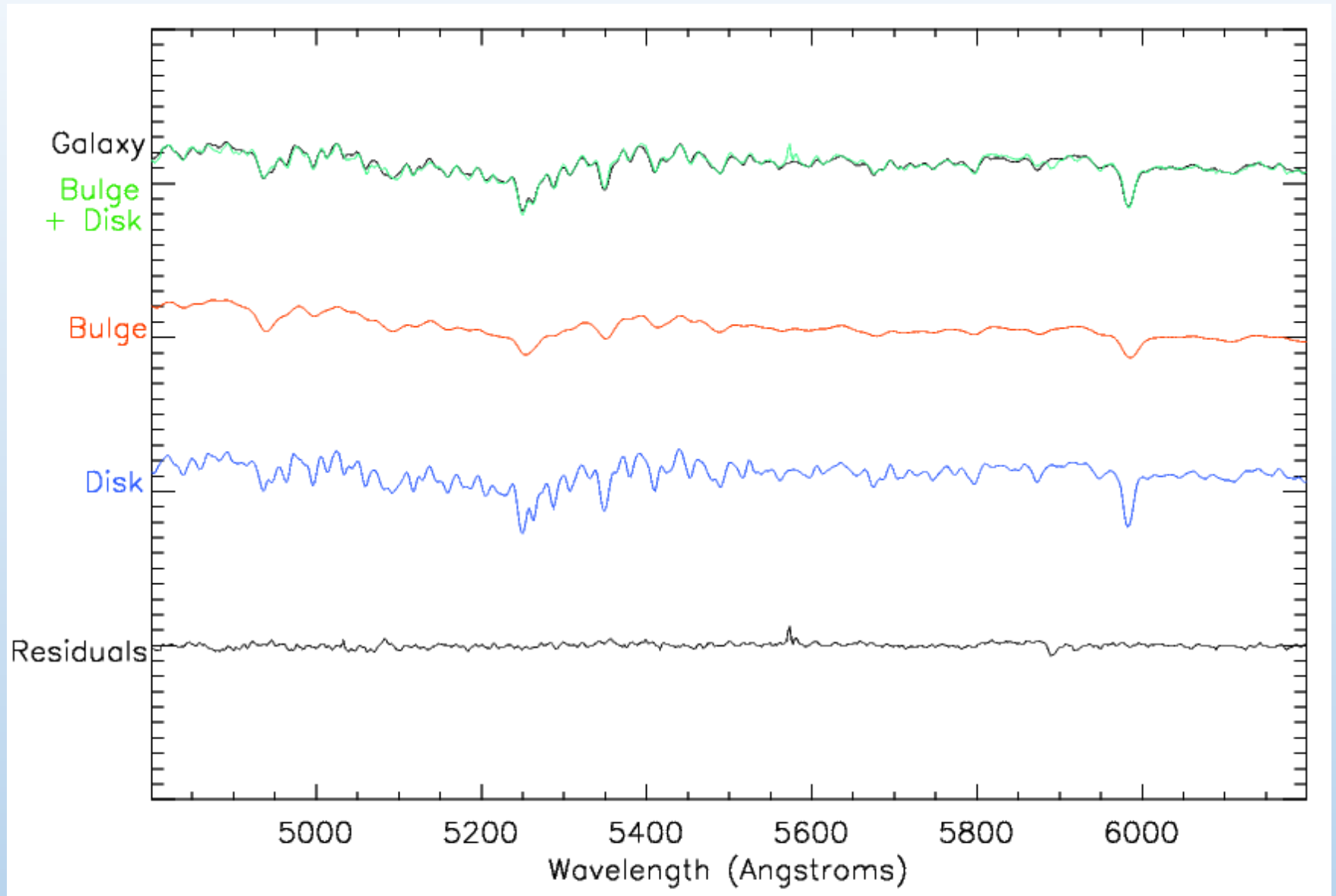


SDSS J152526.28+430947.3



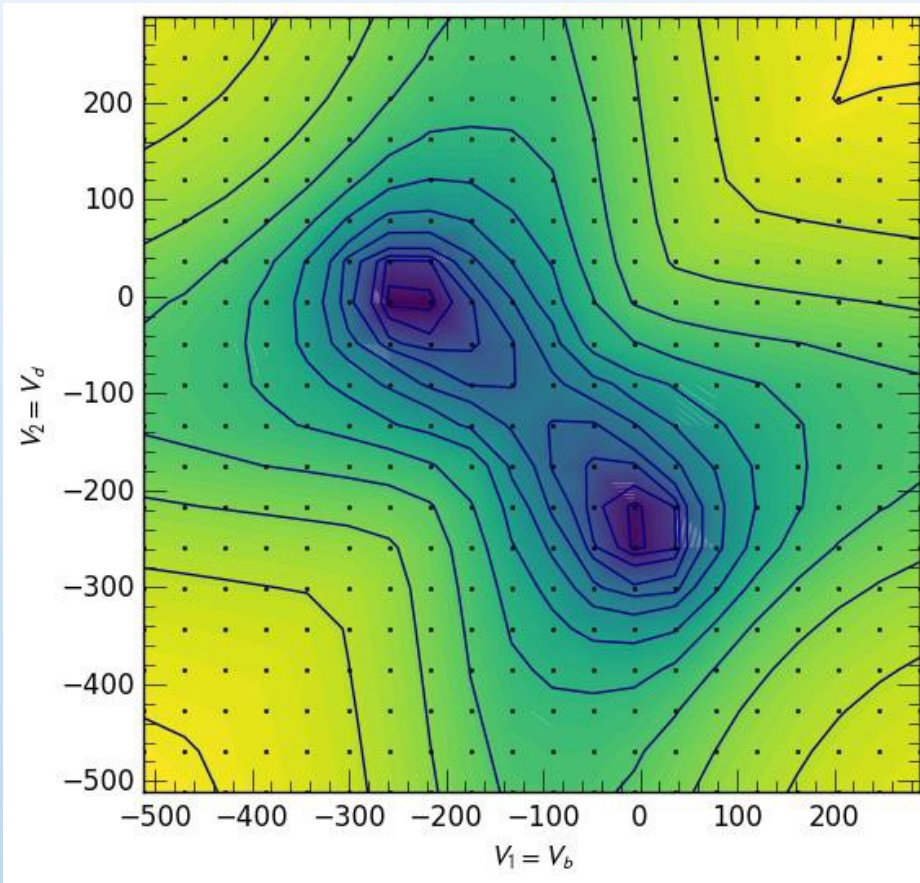
(Johnston *et al.* 2015)

Full Kinematic Fitting of Data Cubes

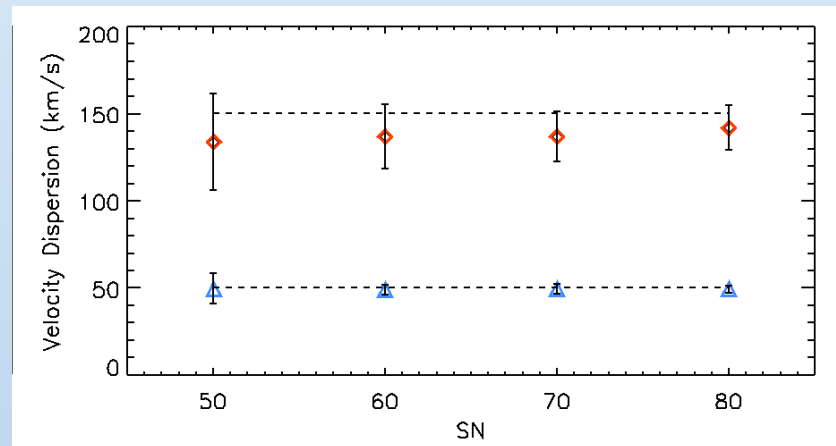
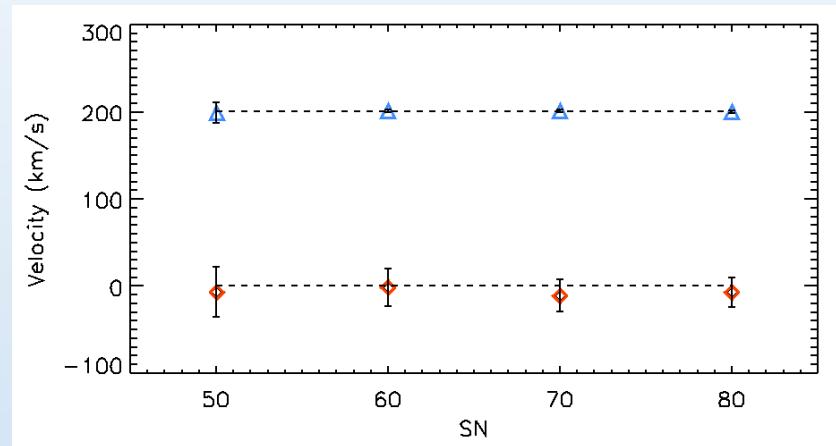


Full Kinematic Fitting of Data Cubes: Testing

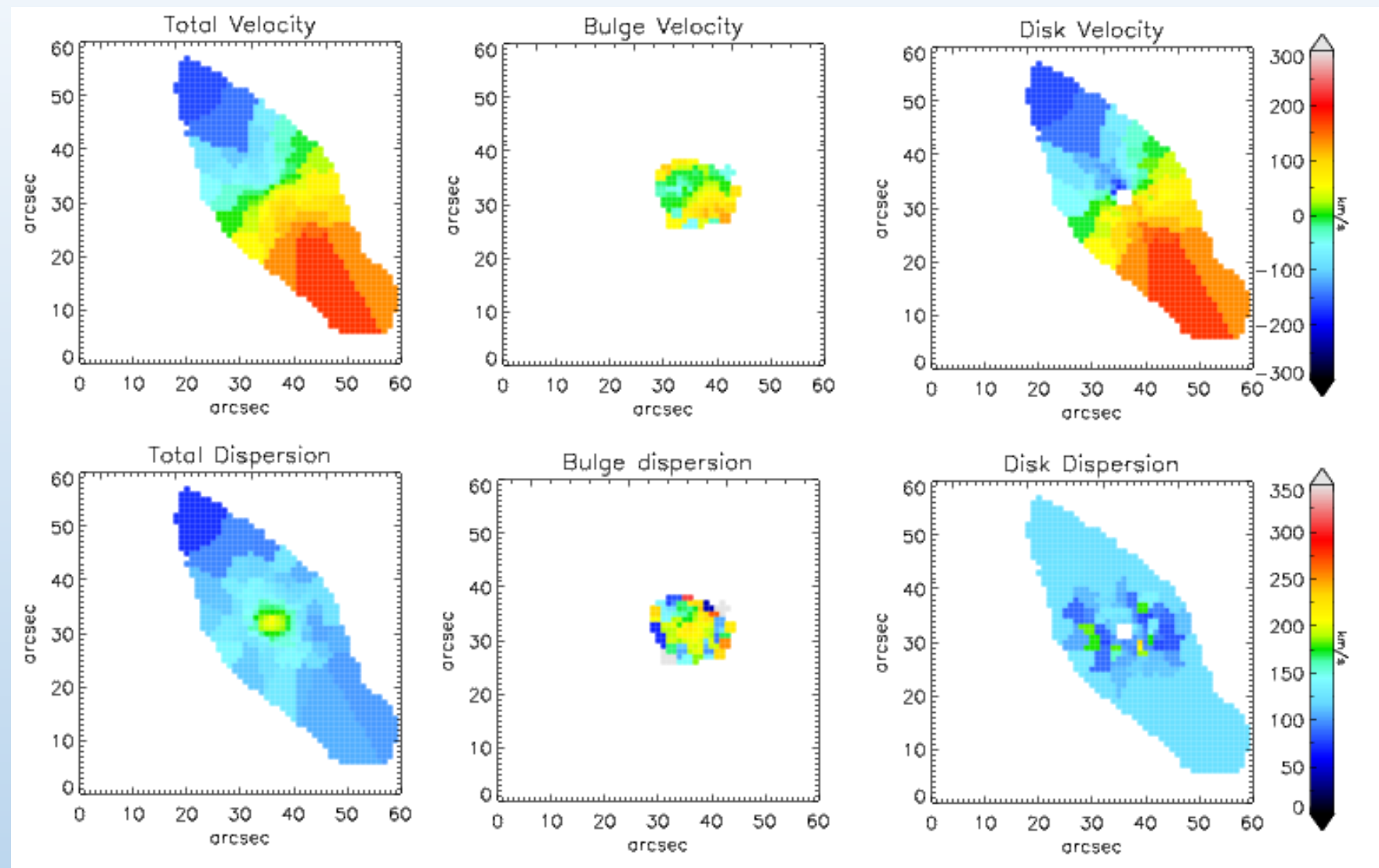
$B/T = 0.5$; $S/N = 60$



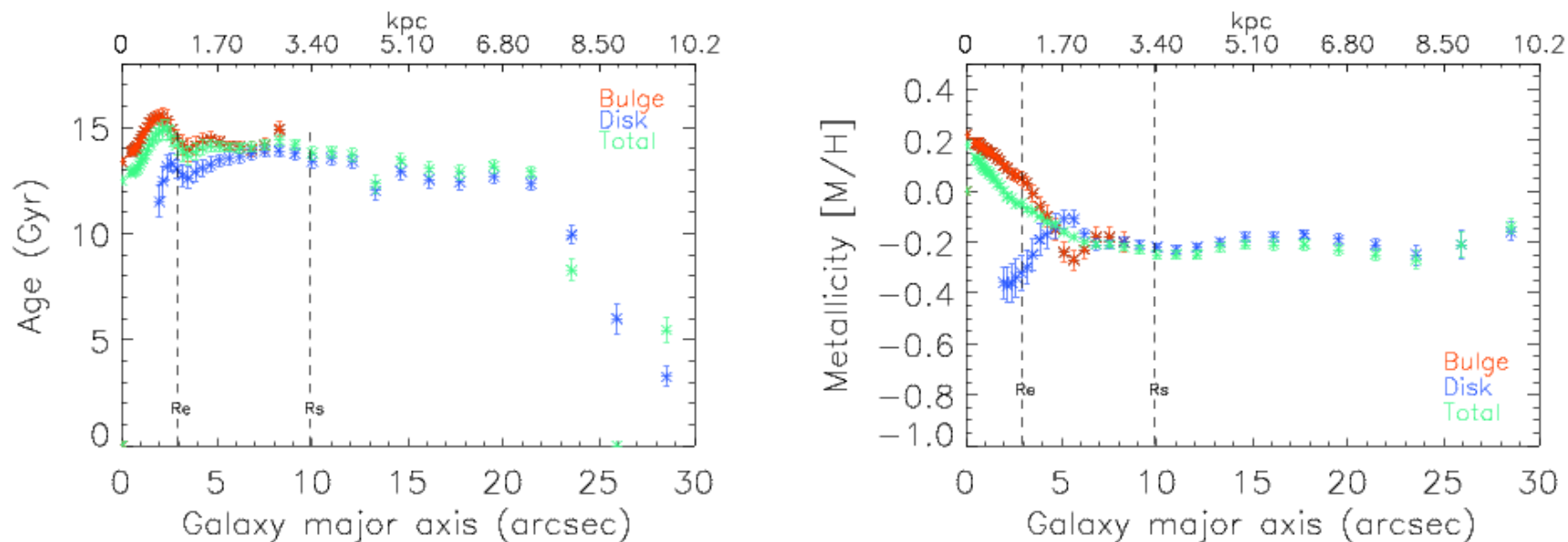
$B/T = 0.2$



Full Kinematic Fitting of Data Cubes: Results



Full Kinematic Fitting of Data Cubes: Results



Summary

- We are now in a position to go beyond knowing that spirals transform into S0s to start addressing how.
- Large IFU surveys are offering a wealth of new data to tackle this question.
- IFU observations of S0 galaxies are just begging to be decomposed into disk and bulge components, and we are developing new tools to do so:
 - Spectral bulge–disk decomposition
 - Constrained kinematic decomposition
- Initial results show S0s' bulges are systematically *younger* and *more metal rich* than their disks, indicating a final burst of star formation at their centres.
- When we include full kinematic information and other data (bulge Sersic index, environment, ...) there is every hope that this question will be definitively answered.