



# Star Formation Histories of S0 Galaxies

SALT Science Conference - 2015

by

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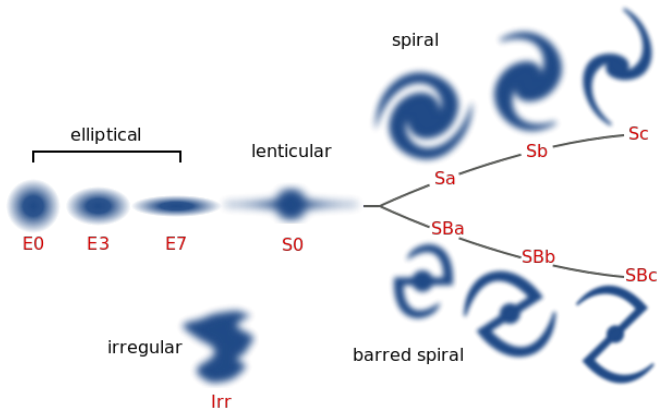
June 2nd, 2015

# Some Acknowledgements

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# Motivation, Past Studies

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Hubble 1936

# Motivation, Past Studies

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The general approach

Assemble a sample of S0 galaxies with imaging data.



Model the surface brightness distribution.



Study statistical correlations between derived parameters.

## Past Results

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“Lenticular Galaxy Formation: Possible Luminosity Dependence” by Sudhanshu Barway, Yogesh Wadadekar, C D Ravikumar, Ajit Kembhavi and Y D Mayya ( 2007, ApJL, 661, L37)

“Near-infrared bulge-disc correlations of lenticular galaxies” by Sudhanshu Barway, Yogesh Wadadekar, Ajit Kembhavi and Y D Mayya (2009, MNRAS, 394, 1991)

## Past Results

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“Bar fraction in lenticular galaxies: dependence on luminosity and environment” by Sudhanshu Barway, Yogesh Wadadekar and Ajit Kembhavi (2011, MNRAS, 410, L18)

“Luminosity dependent star-formation history of S0 galaxies: evidence from GALEX-SDSS-2MASS-WISE colours” by Sudhanshu Barway, Yogesh Wadadekar, **Kaustubh Vaghmare** and Ajit Kembhavi (2013, MNRAS, 432, 430B)

## Past Results

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“A Spitzer Study of Pseudobulges in S0 Galaxies - Secular Evolution of Disks” by **Kaustubh Vaghmare**, Sudhanshu Barway, Ajit Kembhavi (2013, ApJ, 767L, 33V)

“Spirals as Progenitors of Pseudobulge Hosting S0s” by **Kaustubh Vaghmare**, Sudhanshu Barway, Smita Mathur, and Ajit Kembhavi (2015, MNRAS, 432, 430B)

# Past Results

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*Motive: Use spectroscopic data to study individual objects in depth to understand and/or constrain their formation mechanisms.*



We've obtained RSS longslit spectra for a sample of S0 galaxies, with the slit placed along the major axis of the galaxy.

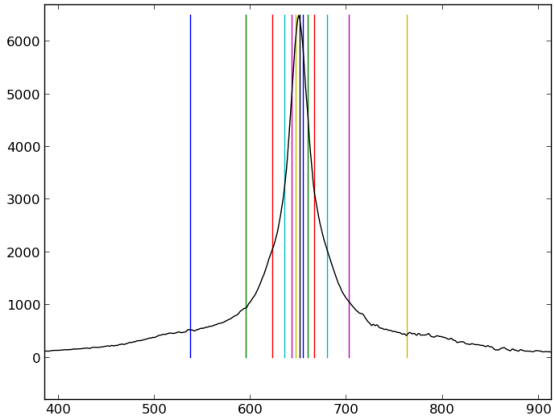
## **Objectives**

- ▶ Extract spectra from different spatial positions along the slit.
- ▶ Model each spectrum using stellar population synthesis techniques.
- ▶ Derive detailed star formation histories by studying trends of various properties across the major axis.

# Challenges

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## Extraction



We've chosen to model the spectrum using Starlight (Cid Fernandes et al.).

## **Basic Functioning**

- ▶ A base is chosen by the user.
- ▶ Starlight fits input spectrum as a combination of the base spectra (population vector).
- ▶ And also models intrinsic extinction, possible deviations from rest frame and velocity dispersion.

# Choosing a base

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We've constructed a base based on the MILES stellar libraries.

Too small a number - inadequate / biased coverage of the parameter space

Too large a number - large computational overheads; strong degeneracies

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Too small a number - inadequate / biased coverage of the parameter space

Too large a number - large computational overheads; strong degeneracies

*Choose a smaller number, but let it span the parameter space!*

# Choosing a base

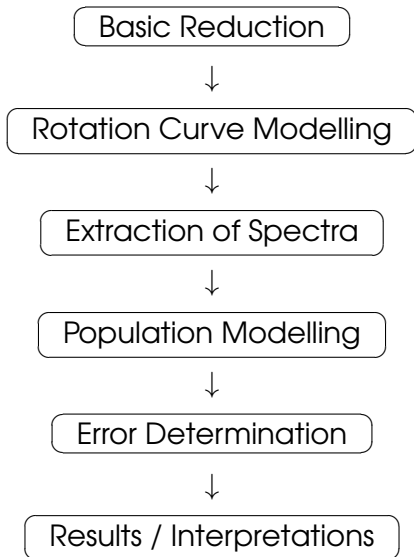
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We adopt the algorithm explained in Richards et al. (2009).

This utilizes the technique of diffusion mapping & K-means clustering to find a new base with a reduced number of spectra that evenly cover the parameter space.

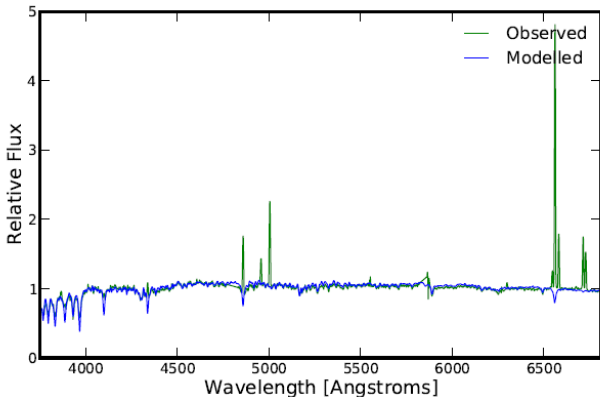
# Workflow Summary

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# Example Results

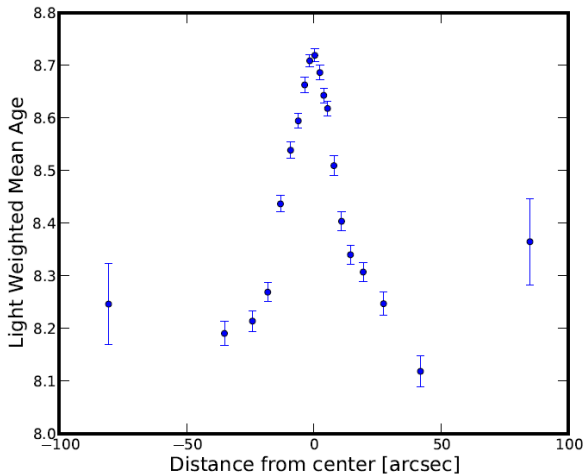
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# Example Results

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# Summary / Conclusions

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- ▶ Several problems relating to basic reduction solved.
- ▶ Many new techniques / codes developed to handle operations such as spectral extraction, coaddition of rows etc.
- ▶ We've started getting high quality results.
- ▶ Interpretation in progress.

Thank You.