# Isolated Galaxies vs Interacting Pairs with MaNGA

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Collaborators: Shiyin Shen, Fangting Yuan, Jun Yin, Ruixiang Chang, Shuai Feng, and MaNGA team







European Week of Astronomy and Space Science 22 – 26 June, 2015

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Laying the foundations: Nature vs. Nurture

Growing Galaxies Inside-Out

**Evolution of Spiral Isolated Galaxies** 

Application to Mergers

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**Evolution of Spiral Isolated Galaxies** 

Application to Mergers

the question arises of "Nature vs. Nurture"

- Like humans, most galaxies live in cities and towns
- A small percentage live alone in the country as farmers or even as hermits





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the question arises of "Nature vs. Nurture"

 In astronomy we can ask which properties of a galaxy are natural to it and which are the result of the environment in which it lives





#### Does the environment matter?

the question arises of "Nature vs. Nurture"

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- Life moves faster
- No evidence of recent star formation
- All their stars are old
- External stimuli have converted all the gas into stars long ago

#### Does the environment matter?

the question arises of "Nature vs. Nurture"

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- Role of the environment in the formation and evolution of galaxies
- Which properties are due to internal secular evolution and which to external influences
- Reference sample with minimum influence from the environment

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Growing Galaxies Inside-Out

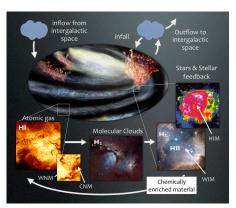
Evolution of Spiral Isolated Galaxies

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#### The inside—out model of galaxy formation

From models, it is predicted that disks grow from inner to outer parts of galaxies



- Mass assembly firstly finished in galactic central region
  - Galactic disk formed by infall of gas at a faster rate in the innermost regions than in the outermost ones

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We expect to observe gradients in stellar age and metallicity as a function of galactic radius

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#### Evolution of spiral isolated galaxies with MaNGA

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How exactly do galaxies build their disk when they grow in isolation, unaffected by external influences?

- Isolated Galaxies
- MaNGA IFUs
- Fossil Record Method
- Chemical Evolution Models

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How exactly do galaxies build their disk when they grow in isolation, unaffected by external influences?

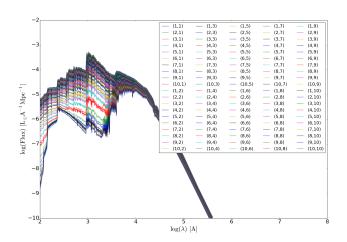
Isolated Galaxies

SDSS-based Isolated Galaxies (SIG, Argudo-Fernández et al. 2015)

- d ≤ 1 Mpc
- $|\Delta v| \le 500 \, \text{km} \, \text{s}^{-1}$  to avoid physical associations
- MaNGA IFUs
- Fossil Record Method
- Chemical Evolution Models

#### Fossil Record Method – Spectral fitting

#### CSP models, BCO3 SSP, Solar metallicity, Salpeter IMF



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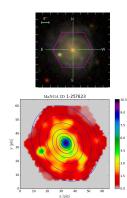
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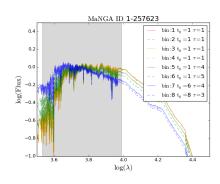
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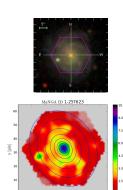
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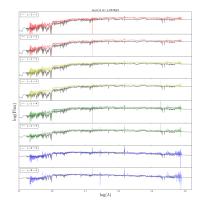
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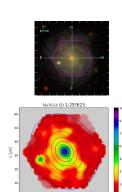
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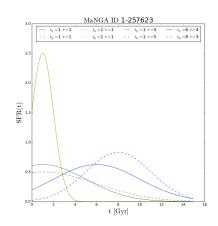
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#### **Chemical Evolution Models**

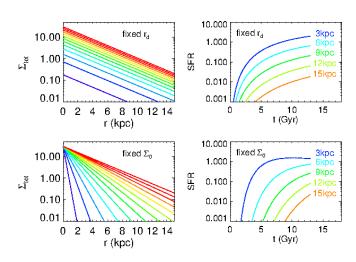
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**Application to Mergers** 

#### Application to mergers: Mrk 848

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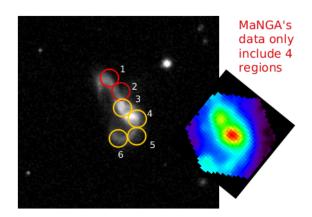
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### Application to mergers: Mrk 848

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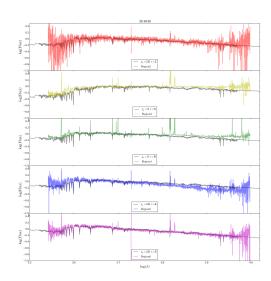
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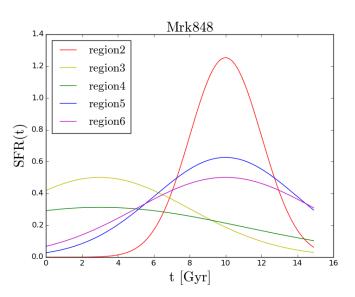
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#### Mergers



#### Application to mergers: Mrk 848



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**Application to Mergers** 

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- Isolated Galaxies in MaNGA:
  - ~80 SIG/year, Argudo-Fernández et al. (2015)
- Follow-up MaNGA observations of close pairs/mergers:
  - ~50 pairs/year, PI: Fangting Yuan
- Working on Spectral Fitting: metallicity, velocity dispersion, dust extinction (emission line fitting)
- Chemical Evolution Models:

 $r_d$ , mass assembly history (multi– $\lambda$  SED modeling)

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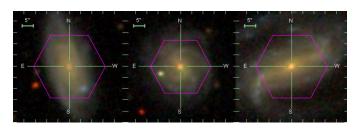
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#### SIG Isolation criterion:

- d ≤ 1 Mpc
- $|\Delta v| \le 500 \,\mathrm{km} \,\mathrm{s}^{-1}$  to avoid physical associations



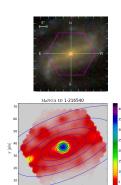
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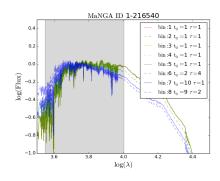


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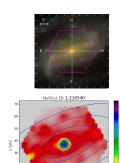
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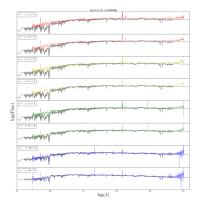
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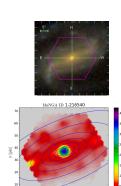
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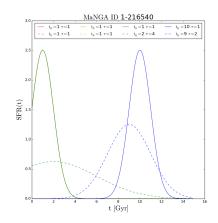
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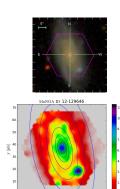
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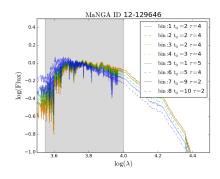
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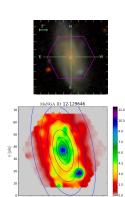


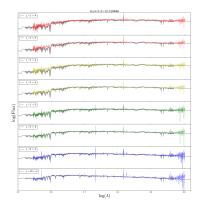


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