

Understanding galaxy evolution through investigation of spatially resolved star formation

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Galaxy Evolution

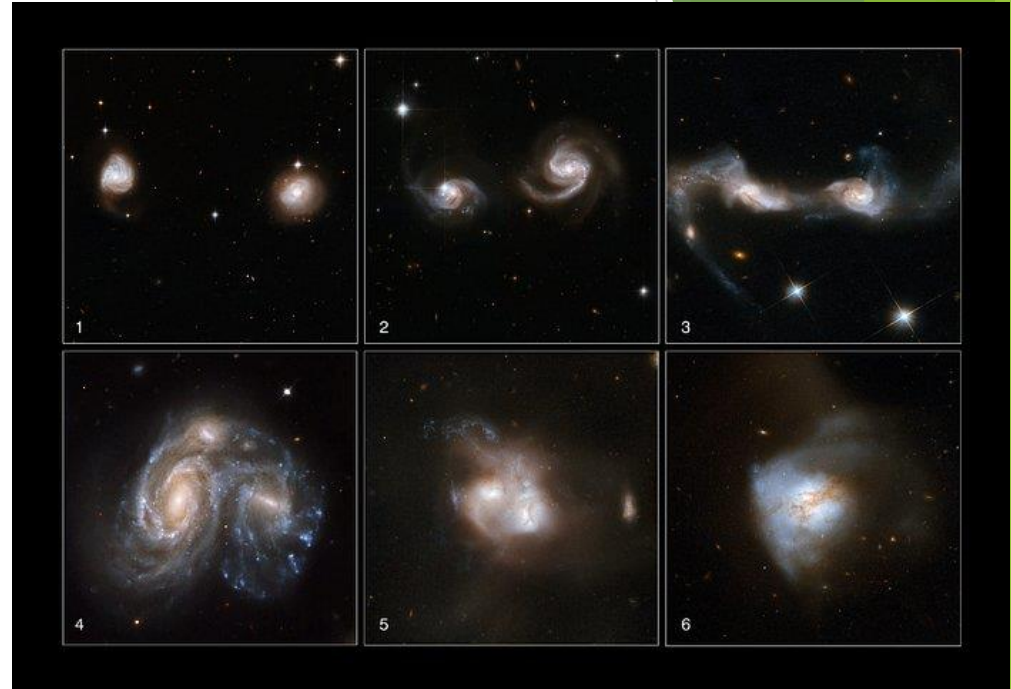
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Galaxies evolve

Understanding galaxy evolution and its associated processes will give us a greater understanding of structure formation in the Universe

One process associated with galaxy evolution is **star formation**

- Star formation events can alter galaxy physical properties over time



Credit: NASA, ESA, the Hubble Heritage Team (STScI/AURA)-ESA/Hubble Collaboration and A. Evans (University of Virginia, Charlottesville/NRAO/Stony Brook University), K. Noll (STScI), and J. Westphal (Caltech)

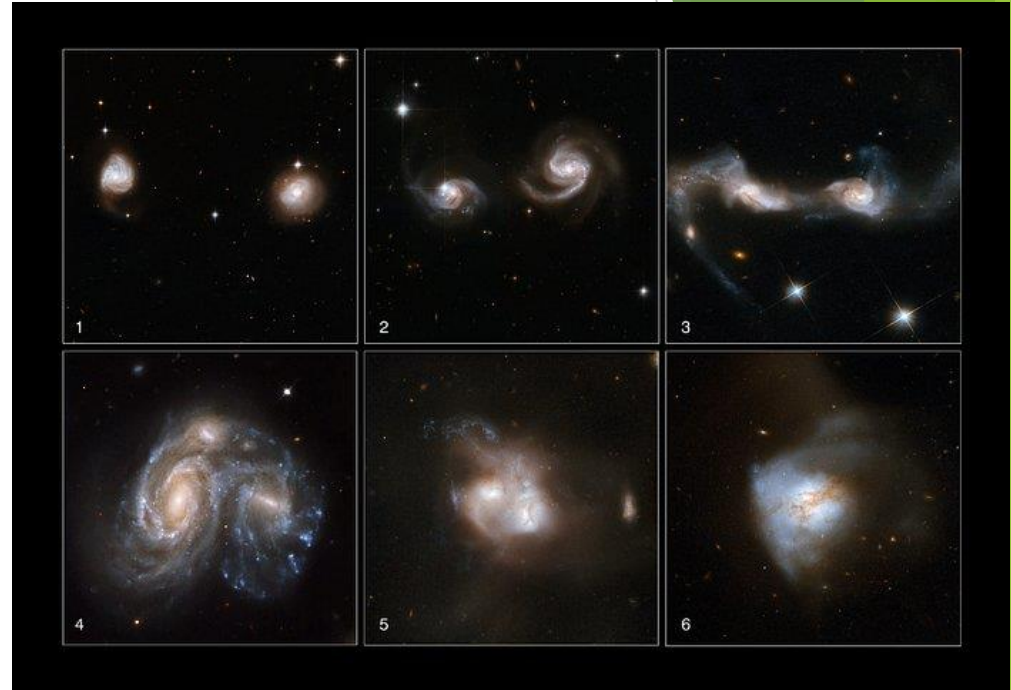
Galaxy Evolution

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- ▶ Understanding galaxy evolution and its associated processes will give us a greater understanding of structure formation in the Universe
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By investigating physical properties associated with star formation, we can understand the evolutionary tract of a galaxy

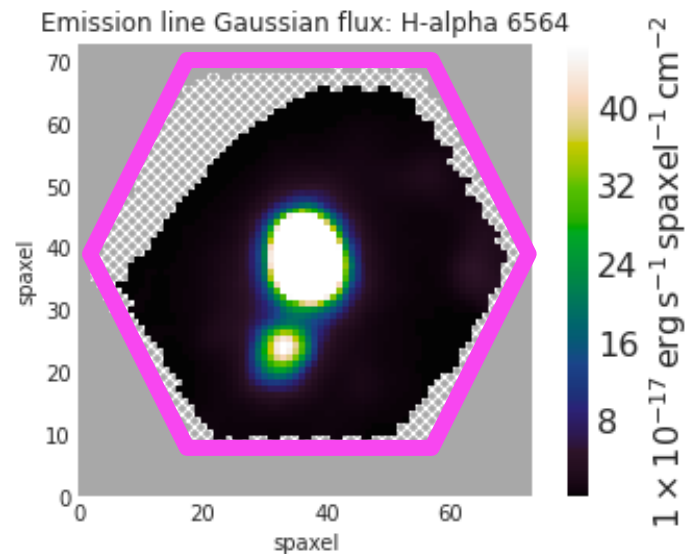
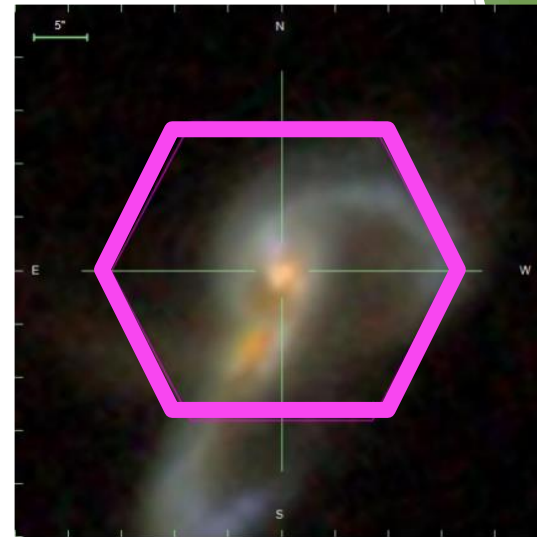


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Spatially Resolved Data

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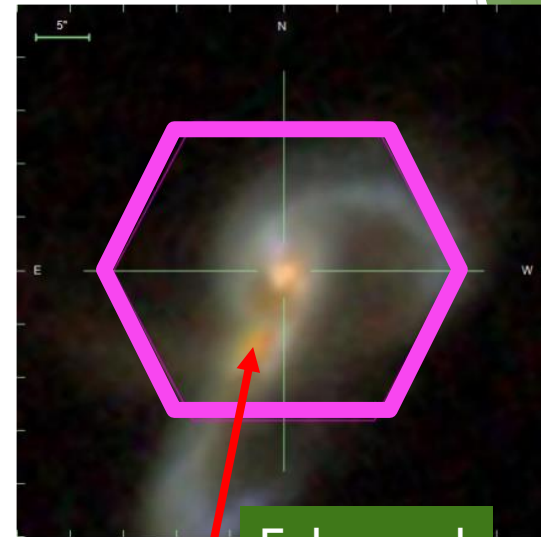
- ▶ Single slit surveys can give us information based on the observations of the **center** of a galaxy, but do not tell us fully about galaxy internal processes
- ▶ Results from **spatially resolved surveys** can help us develop an understanding of the processes that took place during a galaxy's lifetime
 - ▶ Star formation in galaxy outskirts
 - ▶ Complex kinematics associated with star formation
- ▶ Advances in spectroscopic technology has given us access to spatially resolved data to conduct studies



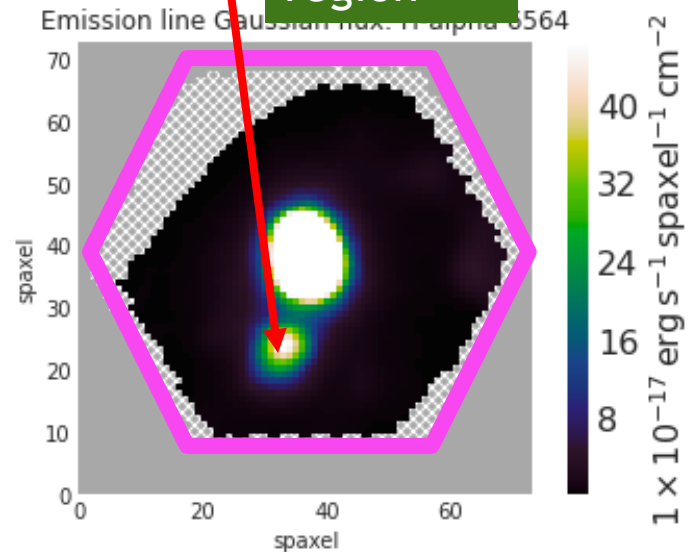
Spatially Resolved Data

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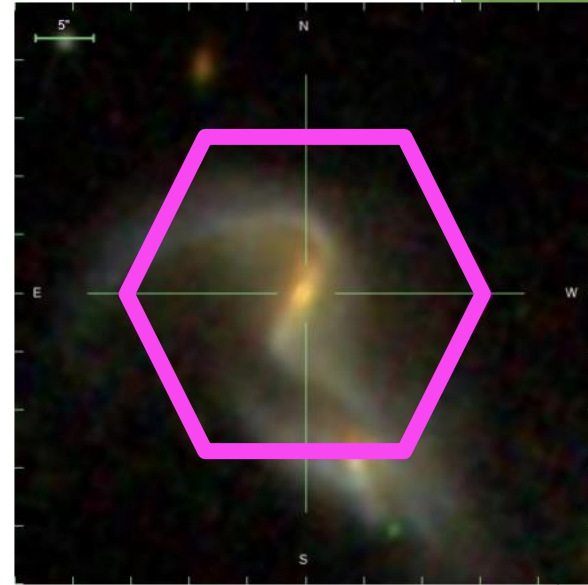
Enhanced
H α flux
region



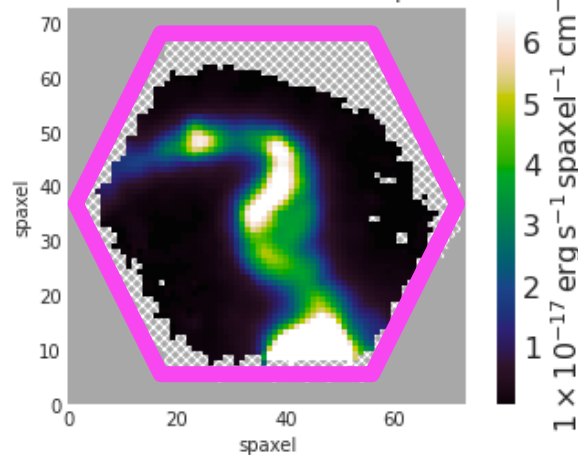
Spatially Resolved Properties of Interacting Galaxies

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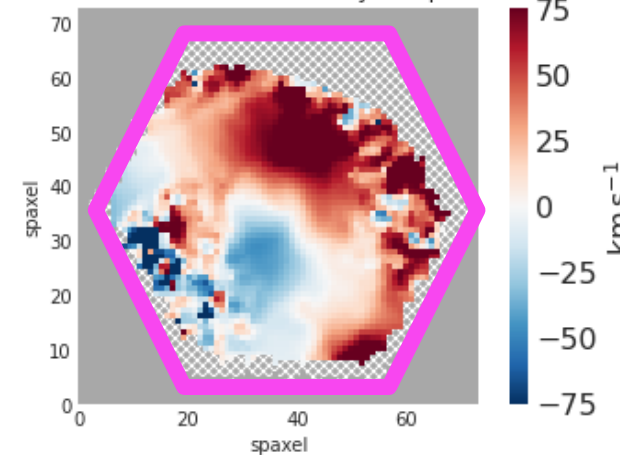
- ▶ **Galaxy interactions and mergers** are a fundamental and important process when discussing galaxy evolution, commonly associated with **enhanced star formation**
- ▶ Using **spatially resolved survey results** can allow us to have a deeper understanding of interacting galaxy systems
 - ▶ **Spatially resolved star formation** - location of starburst/enhanced star formation regions (bottom left image)
 - ▶ **Emission line diagnostics** - Spatially resolved star formation history/evolutionary pathway
 - ▶ **Stellar/gaseous kinematics** - Investigate kinematic disturbances present in interacting galaxy systems (bottom right image)



Emission line Gaussian flux: H-alpha 6564

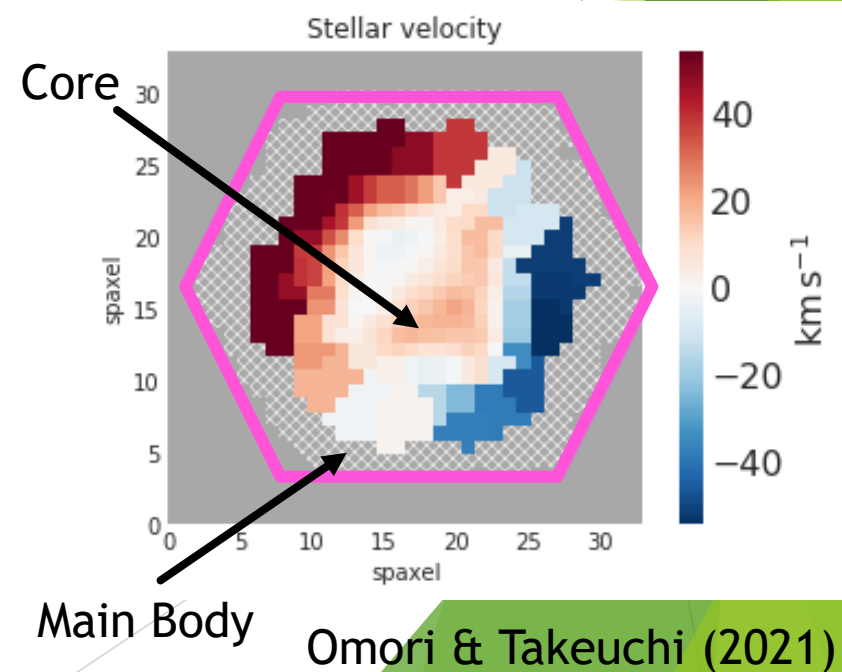
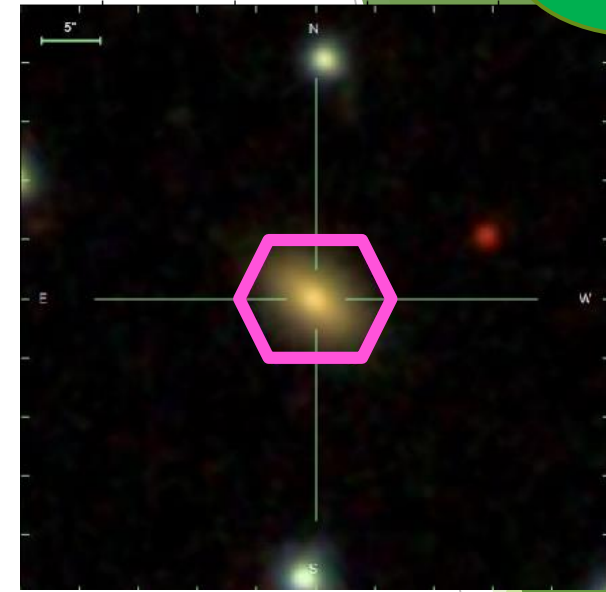


Emission line Gaussian velocity: H-alpha 6564



Merger Galaxy Identification Through Spatially Resolved Kinematics

- ▶ Galaxy interactions can cause **disturbances in stellar and gaseous kinematics**
 - ▶ E.g. Asymmetries, tidal tails, kinematically distinct cores
- ▶ Some merger-related disturbances can be difficult to observe with imaging data
 - ▶ **Incorrect/inaccurate merger classifications**
- ▶ Using spatially resolved kinematics can help us **identify interacting galaxies previously considered isolated**
 - ▶ Fly-by interactions, **counter-rotating galaxies (image)**



Conclusion

- ▶ Investigating **star formation** will give us a deeper understanding of **galaxy evolution**
- ▶ **Spatially resolved observational data** can help draw a more full picture of the evolutionary pathway of a galaxy
- ▶ Using spatially resolved data to study **interacting galaxies** will help in understanding the process
 - ▶ Physical processes
 - ▶ Identification