# SAMI : Sydney-AAO Multi-object Integral-field spectrograph

**Dr Julia Bryant**

**University of Sydney**
**AAO**
**CAASTRO**

# Outline

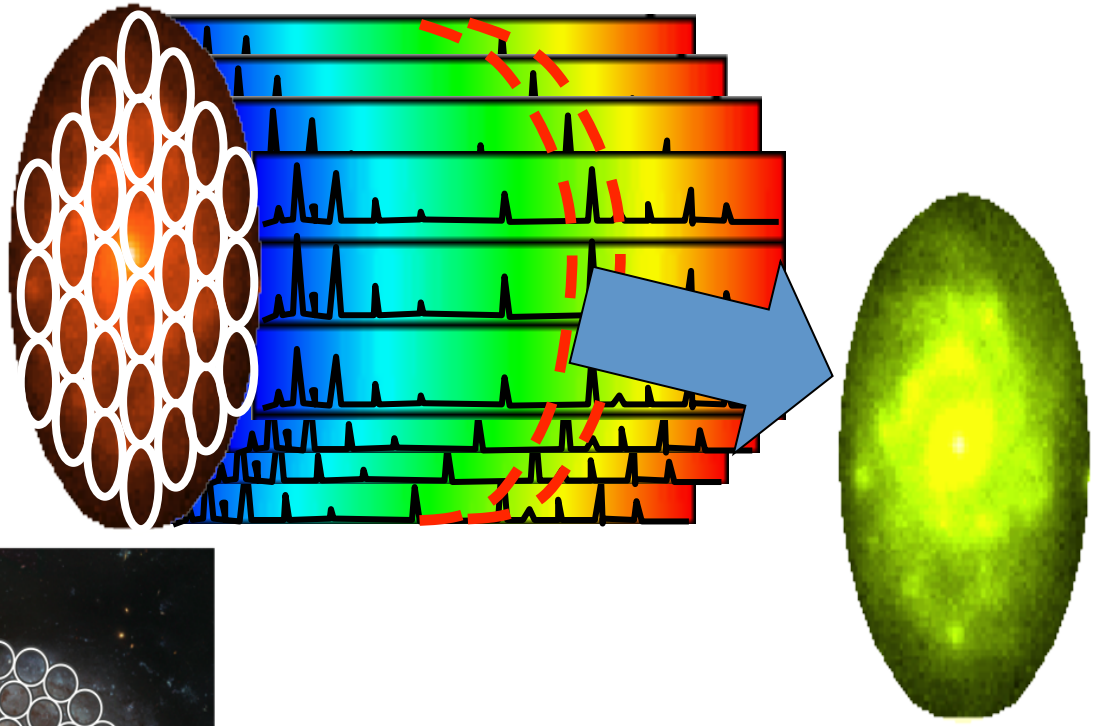
The SAMI instrument:

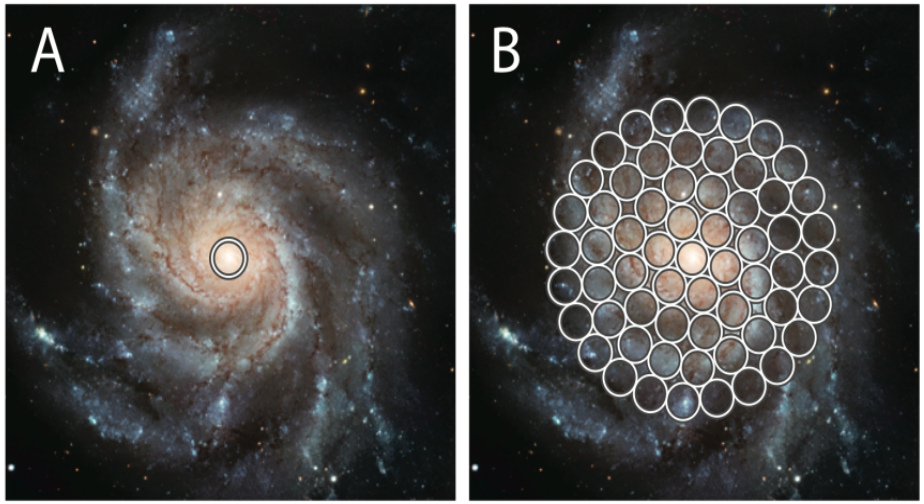
- **Hexabundles**: The key to SAMI.
- Lessons learnt about fibres.
- SAMI survey specifications and performance.

# Hexabundles- optical fibre IFUs

Require multiple positionable IFUs in place of single fibres.

**Hexabundles** –optical fibre IFU, giving a spectrum from each optical fibre core.





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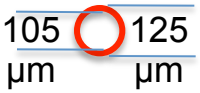
# Hexabundles for SAMI

105μm core/125 μm cladding fibres.

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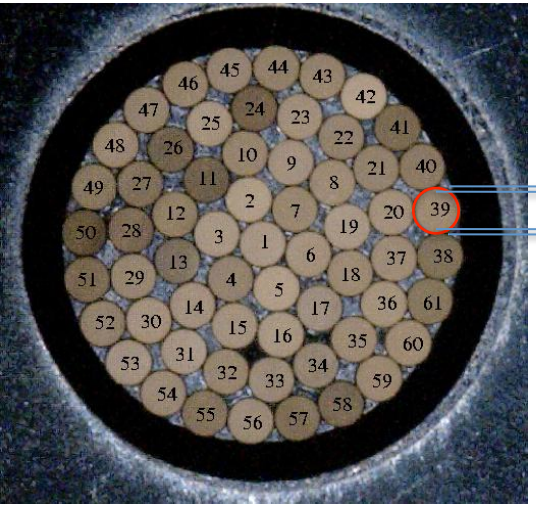




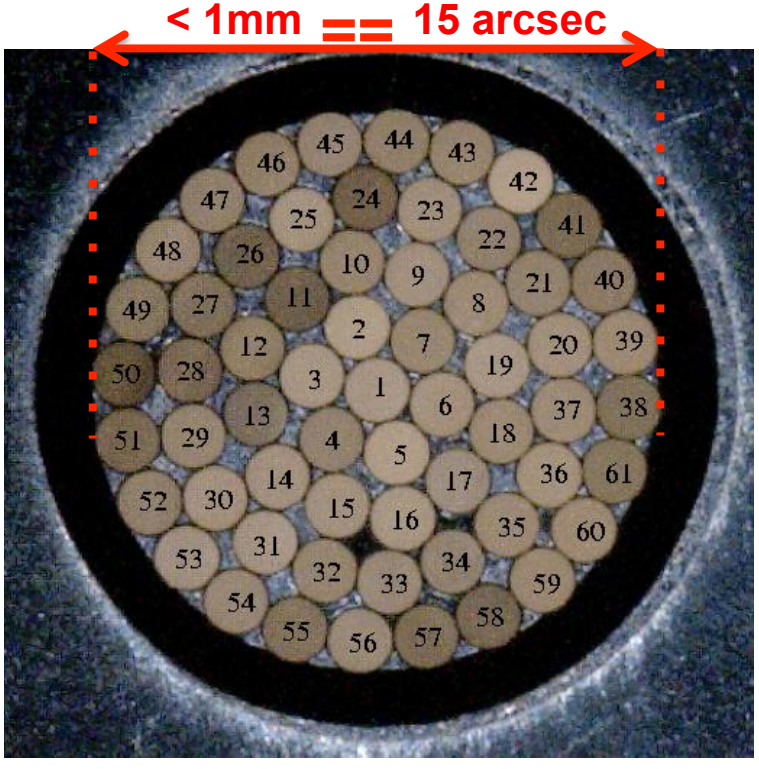


61 optical fibres fused together using our glass fibre processing unit at Sydney Uni.

# Hexabundles for SAMI

## Advantages of this design:

- 1mm diameter

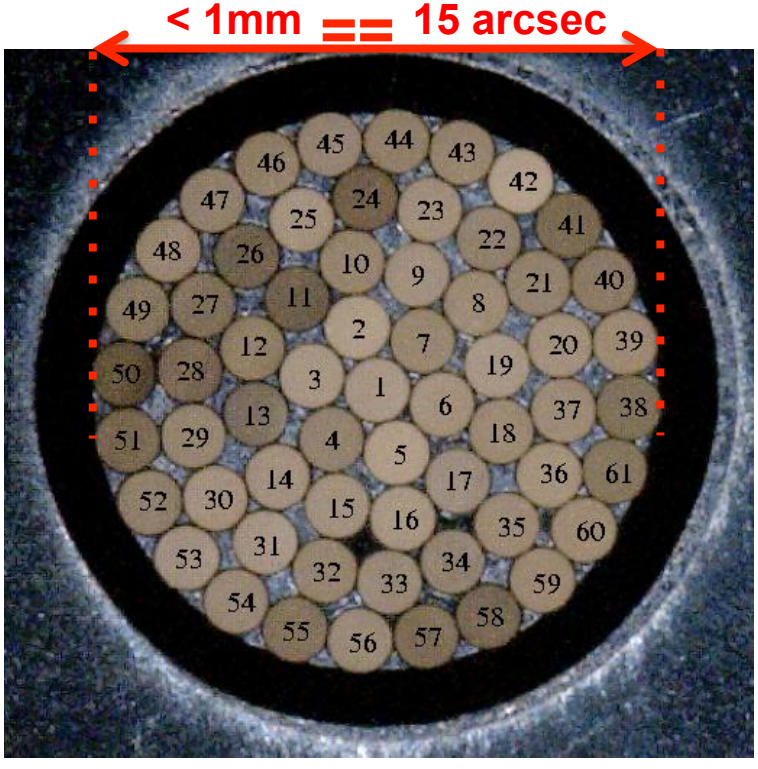


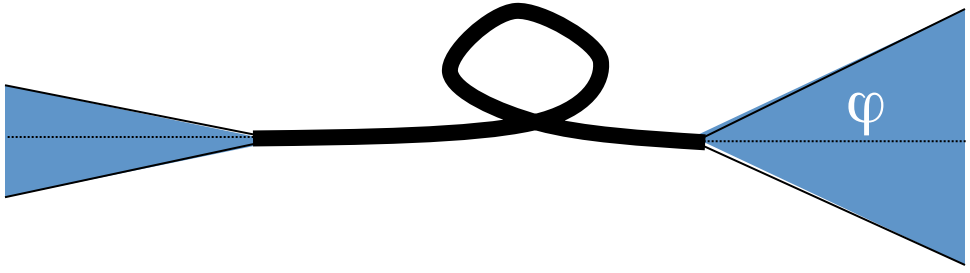

Bryant et al. 2014, 2012a, 2012b, 2011, 2010.

# Hexabundles for SAMI

## Advantages of this design:

- 1mm diameter
- Low Focal Ratio Degradation (FRD) ….as good as for single fibres.



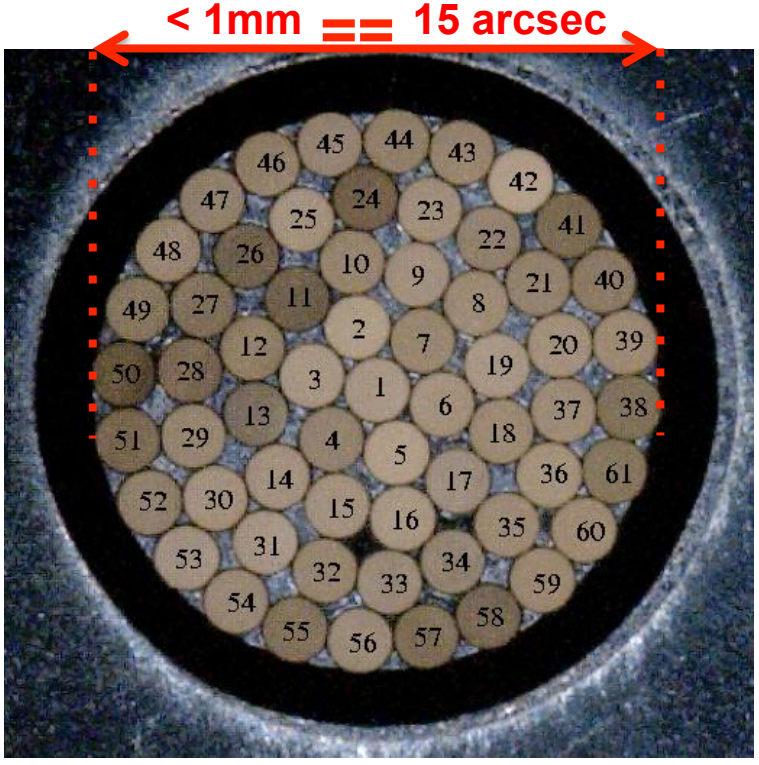

f/3.4 input hexabundles
f/3.15 acceptance into AAOmega spectrograph

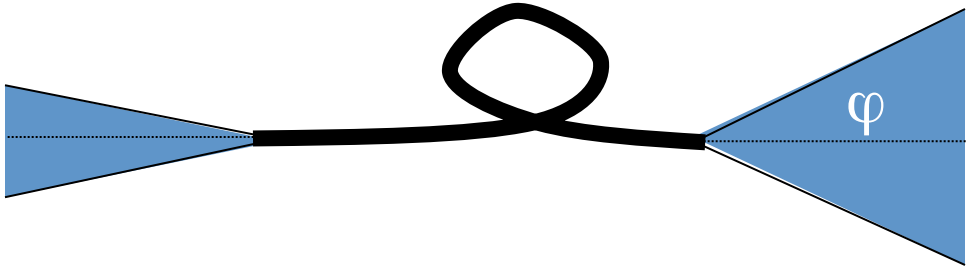
**Bryant et al. 2014, 2012a, 2012b, 2011, 2010.**

# Hexabundles for SAMI

## Advantages of this design:

- 1mm diameter
- Low Focal Ratio Degradation (FRD) ….as good as for single fibres.
- Fill fraction (Area of fibre cores/total bundle area) ~75%.
- Low cross-talk < 0.5%

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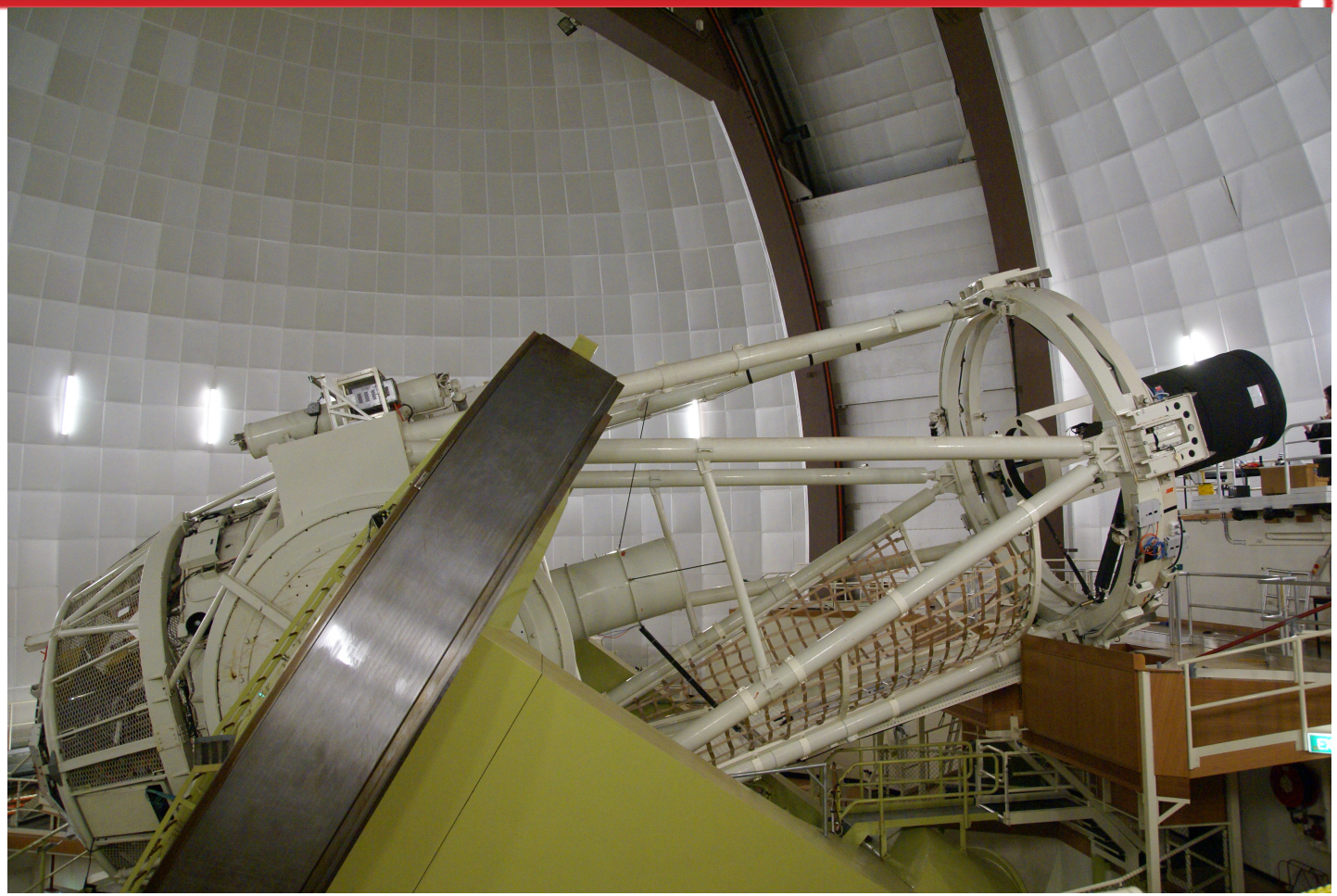
# SAMI Sydney-AAO Multi-object Integral-field spectrograph



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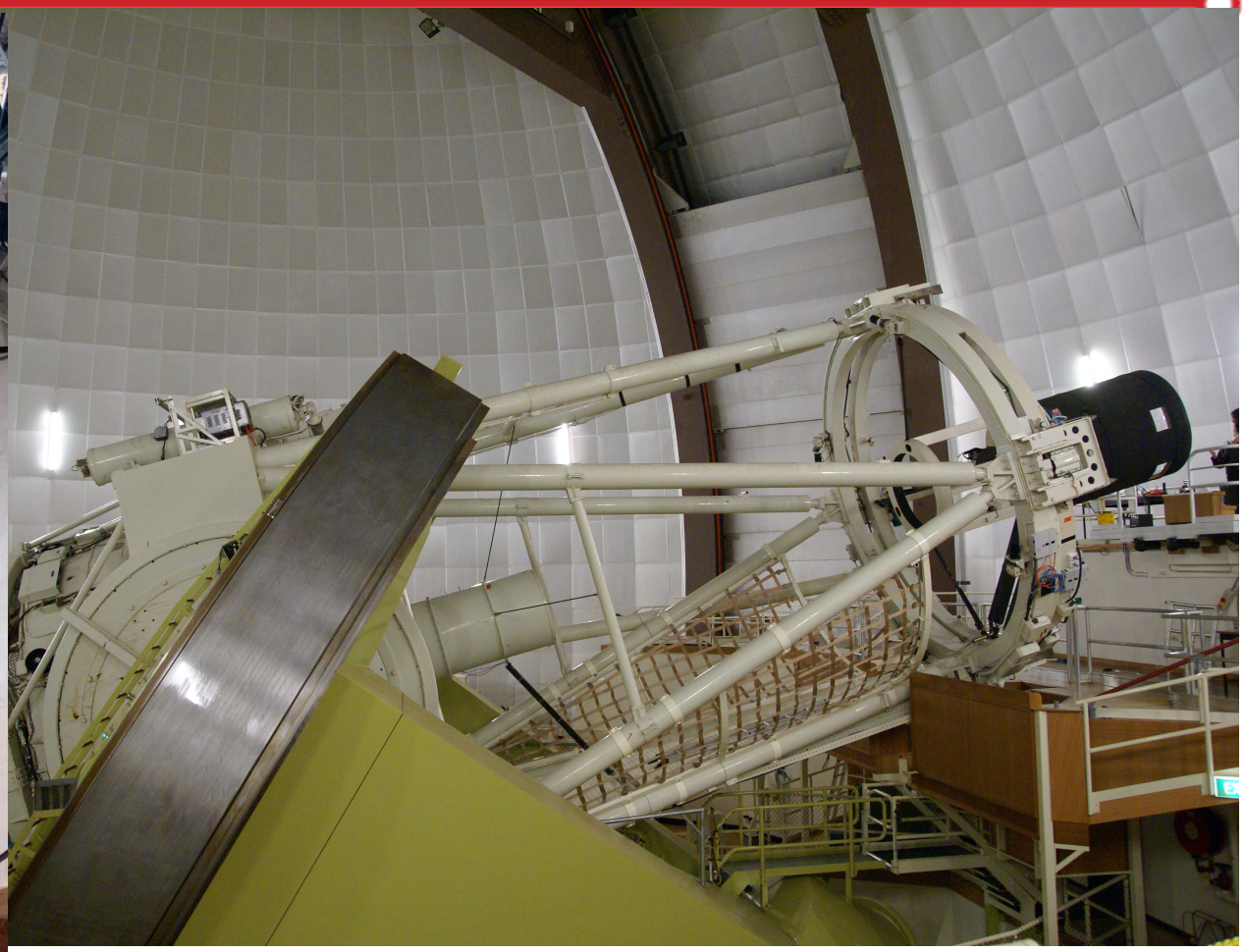

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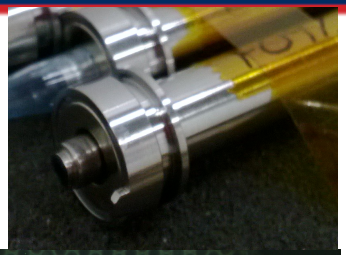
# SAMI Sydney-AAO Multi-object Integral-field spectrograph

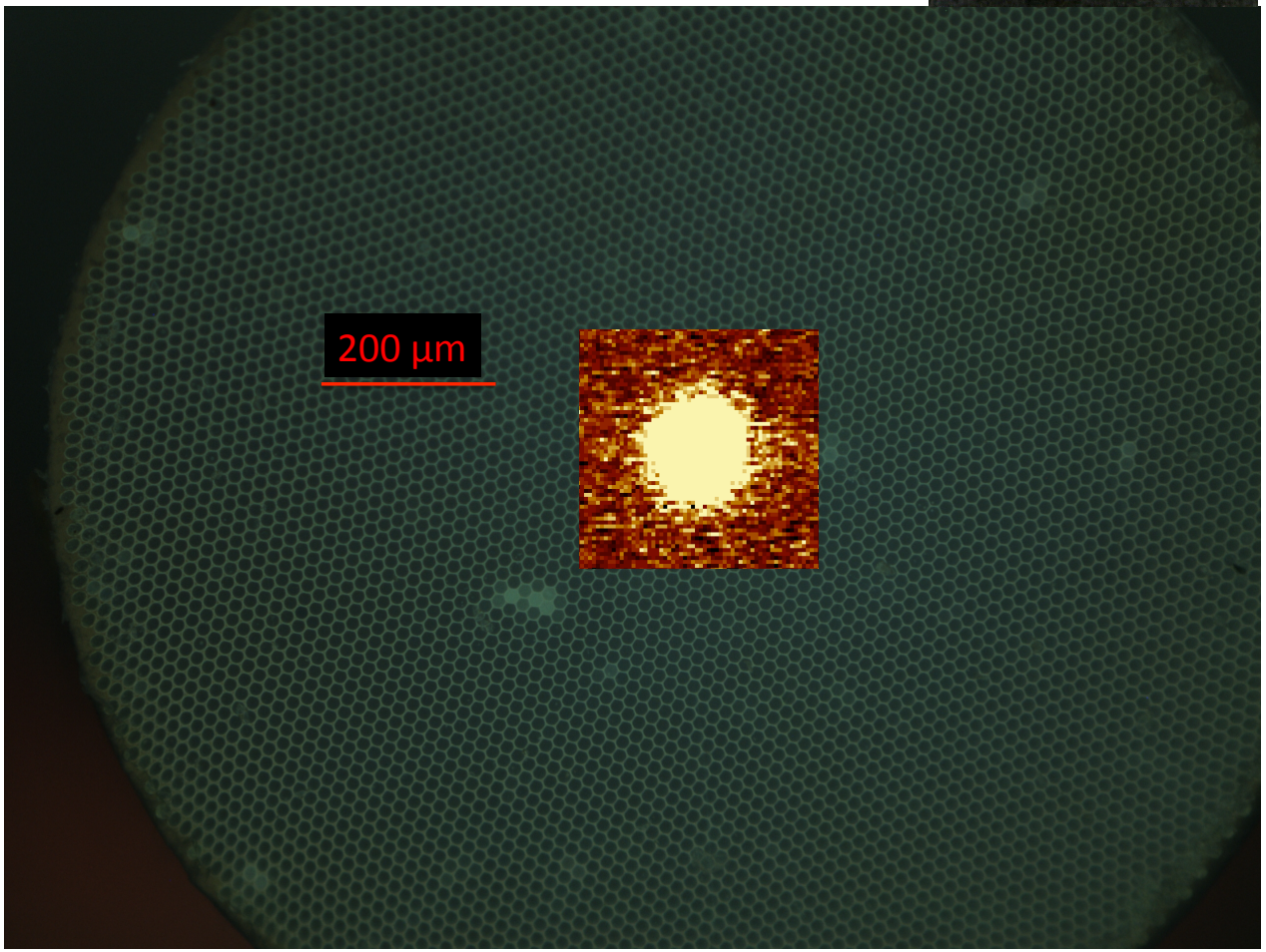
- AAOmega slit allows 819 fibres.

**13 bundles + 26 sky fibres in 1° field.**

# SAMI guide bundles

- Coherent Polymer imaging bundles

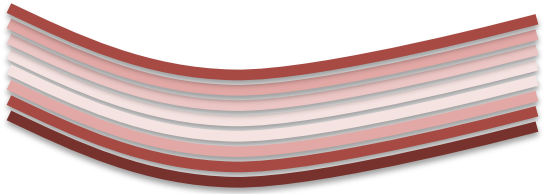


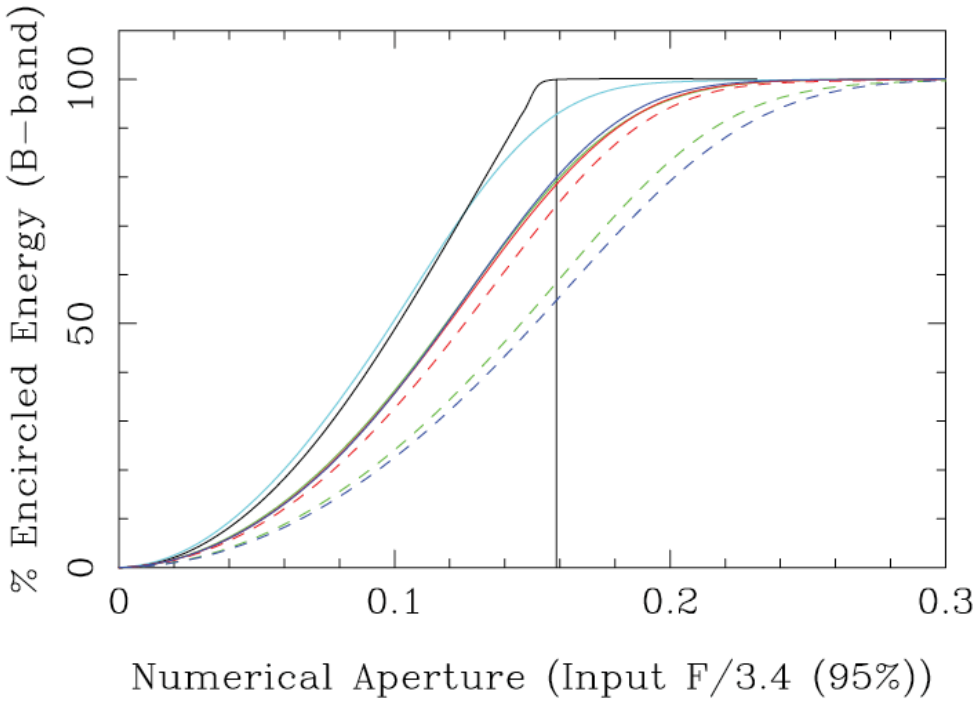


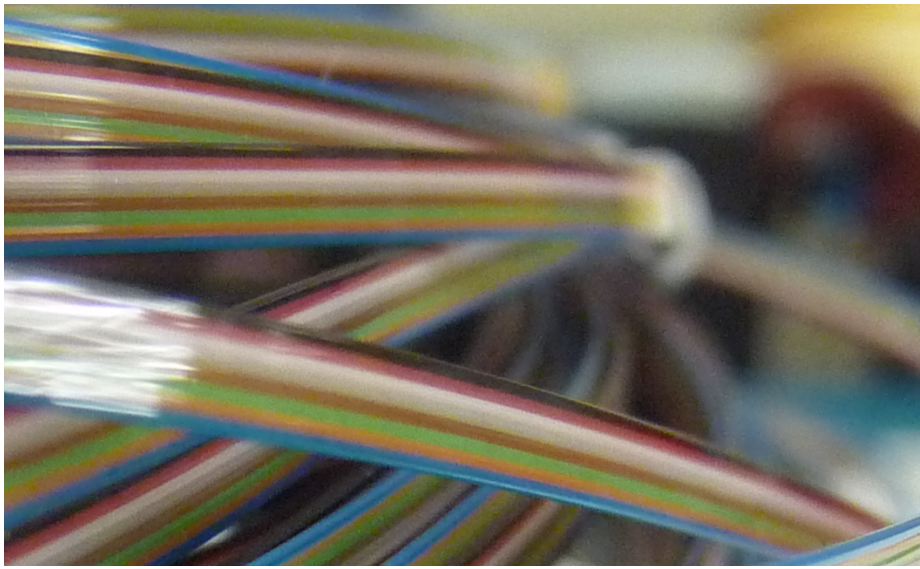

- 7095 cores, 16 microns each.
- f.o.v 22.8” (0.081”/pix)
- 70-80% throughput
- V<14 mag stars
- Fitted into same connector as hexabundle to plug into plate.
- Guide stars can be anywhere in the 1 degree field.
- Allows fast telescope focus.
- Eliminates flexure issues.

# What did we learn?

- Ribbonising fibres is a bad idea
  - Ribbonising causes FRD loss due to differential stress.
  - >50% loss in throughput due to FRD





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- Ribbonising fibres is a bad idea
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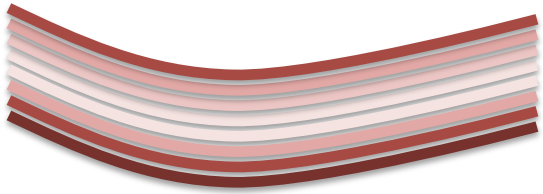
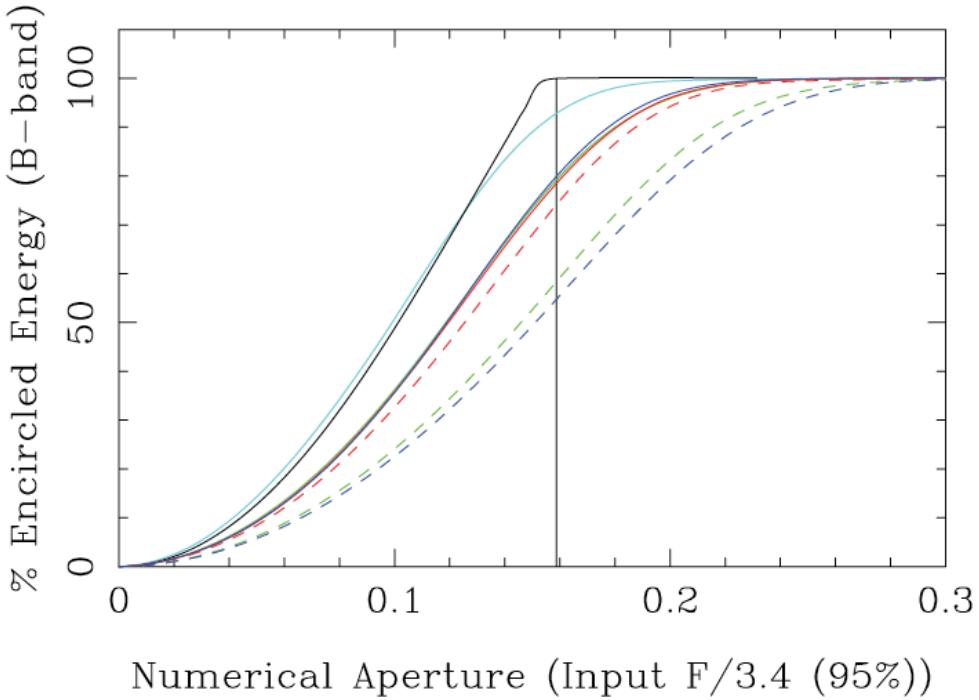
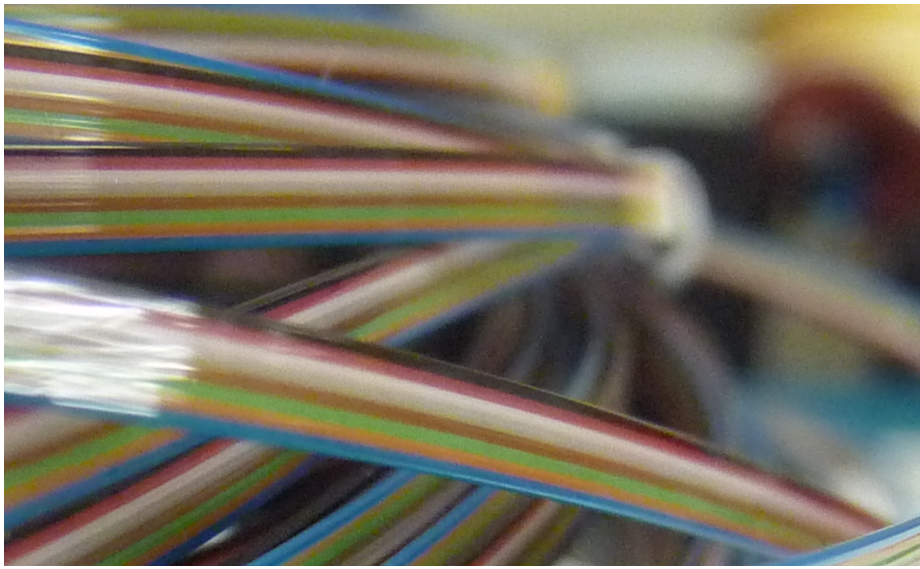
  - >50% loss in throughput due to FRD
- Hytrel coating increases FRD





# SAMI Galaxy Survey

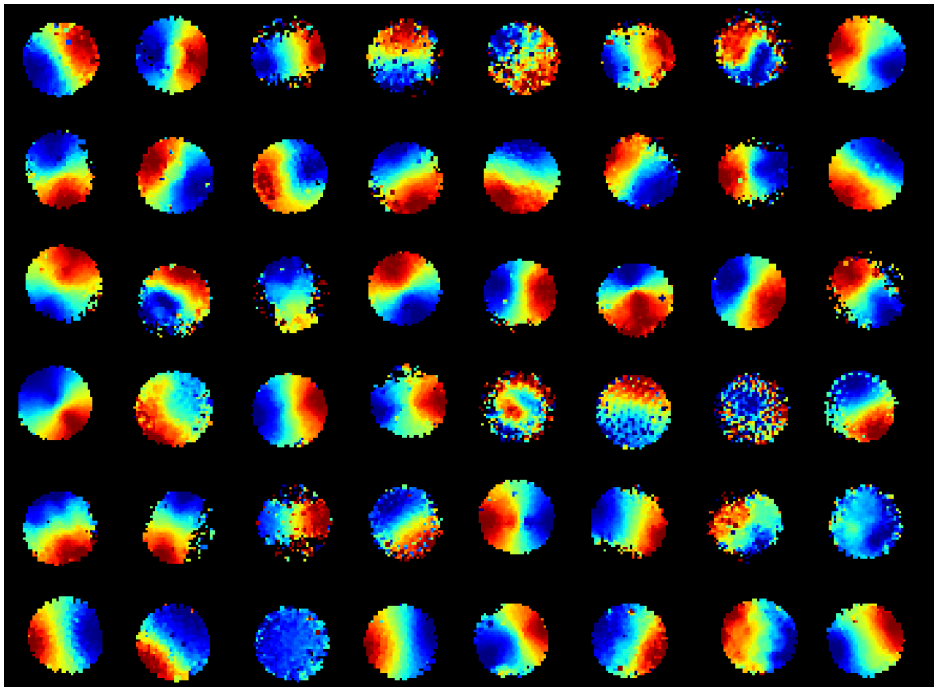
http://sami-survey.org/

- SAMI Galaxy Survey team of >60 astronomers from Australia and internationally.

Croom et al. 2012

- Key science:
  - physical processes driving galaxy transformations,
  - build up of mass and angular momentum in galaxies,
  - how does gas get into/out of galaxies (feedback and feeding)
- The galaxy survey began in March 2013.
- 151-181 nights awarded – from 2013B-16A.
- 3400 galaxies = 2800 field/group galaxies + 600 cluster targets

**>1000 observed already!**

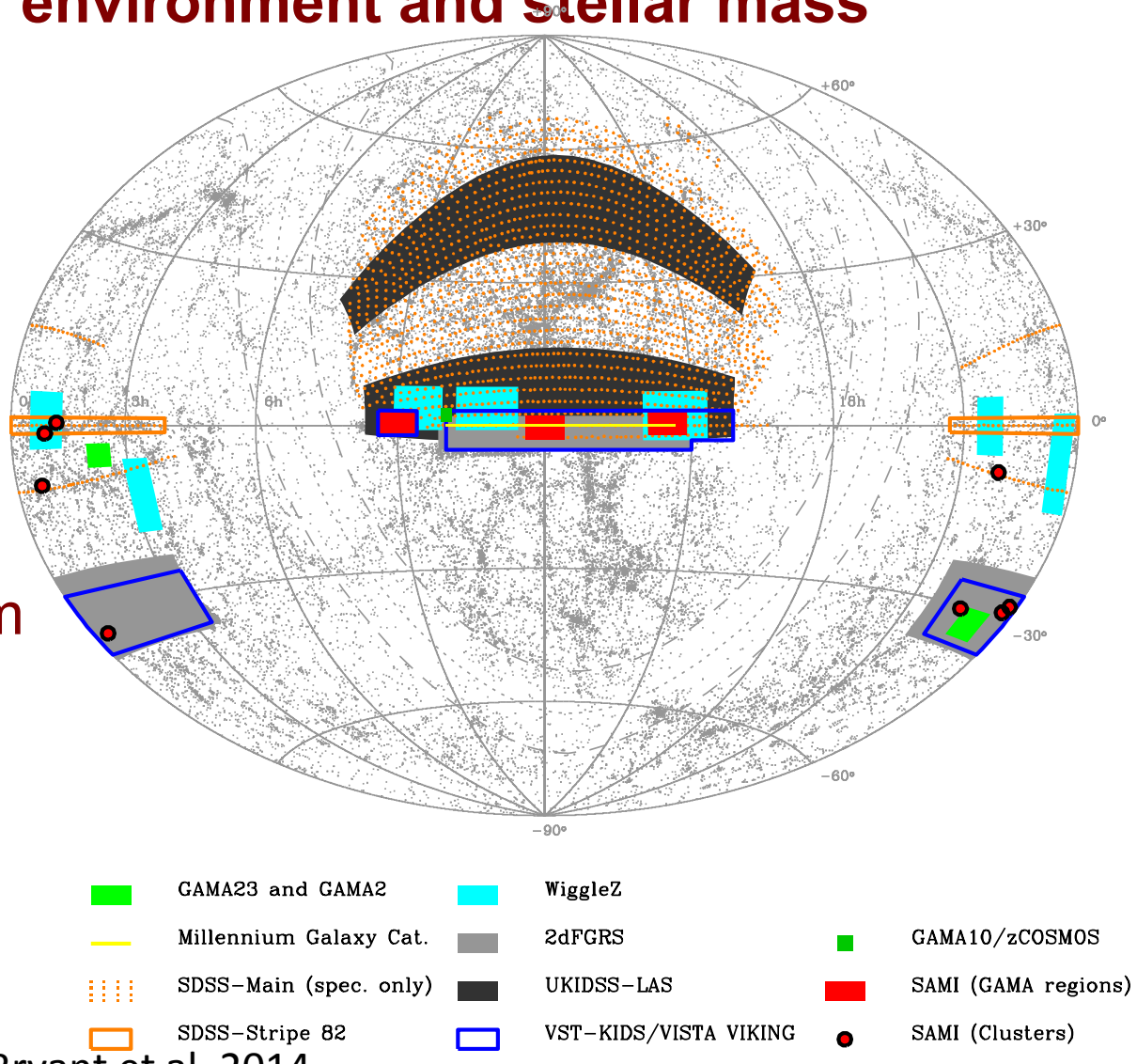


**Public data release of 107 galaxies available**
**http://sami-survey.org/edr**

# SAMI Galaxy Survey
# Target selection

## Aim: Broad range in environment and stellar mass

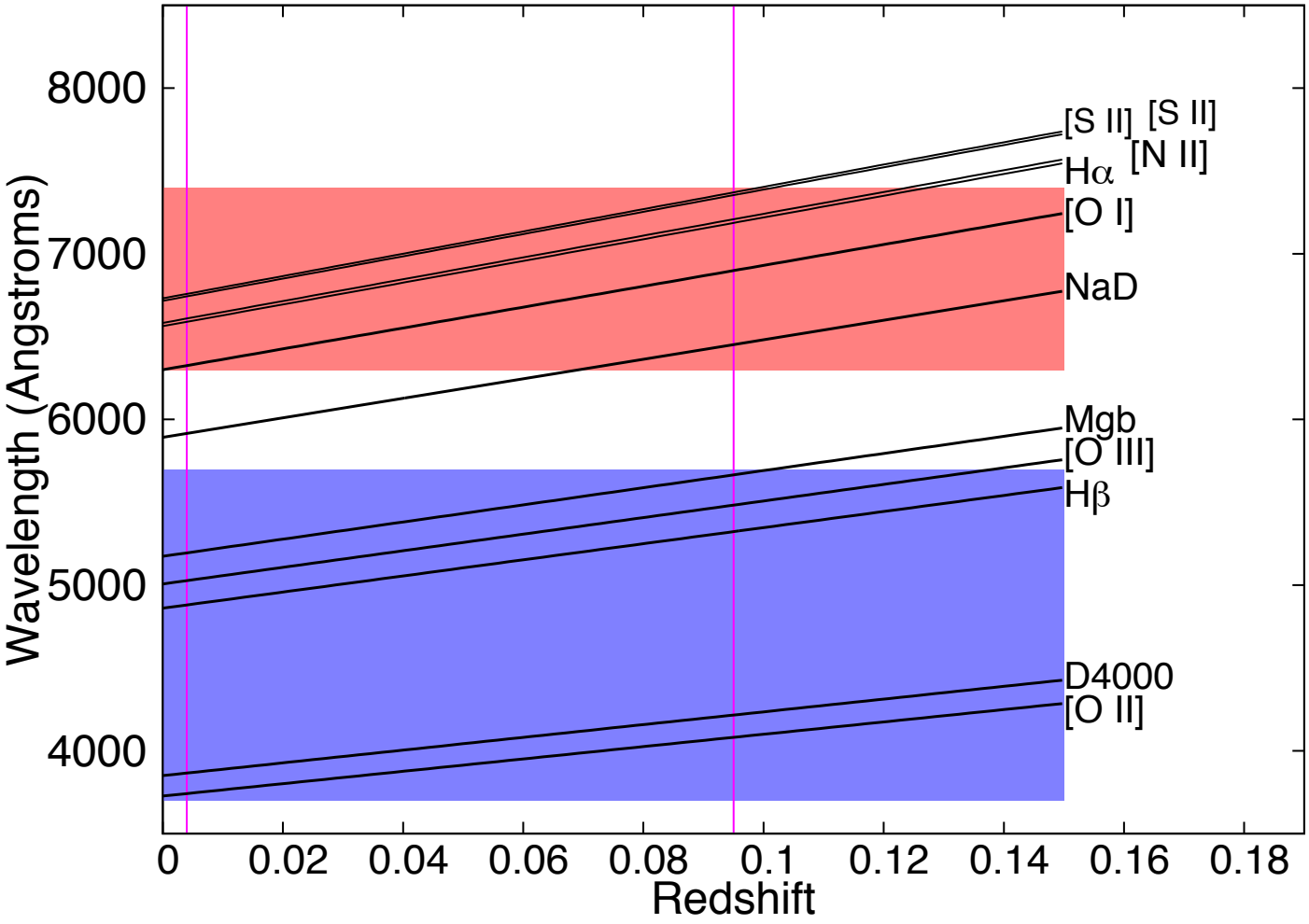
- SAMI target density: 12 hexabundles; 1 degree field.
- Field/group galaxies from GAMA
- Cluster galaxies from 8 clusters.
- Ancillary data




SAMI Target selection paper: Bryant et al. 2014

# SAMI Galaxy Survey
# Instrument setup

- Galaxy features vs. redshift:

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- 580V grating, 3700-5600A, R=1700

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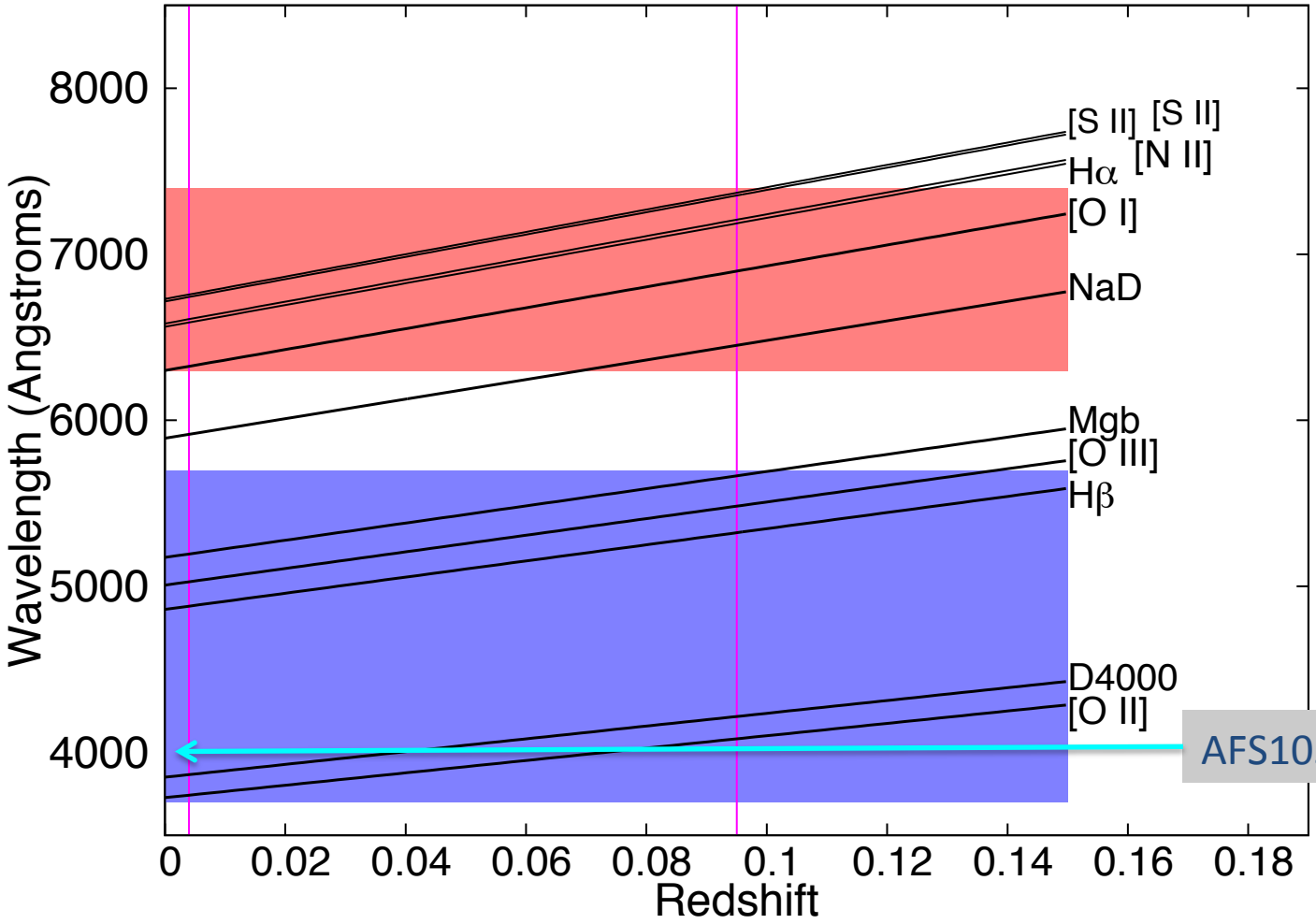


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AFS105/125 60% throughput

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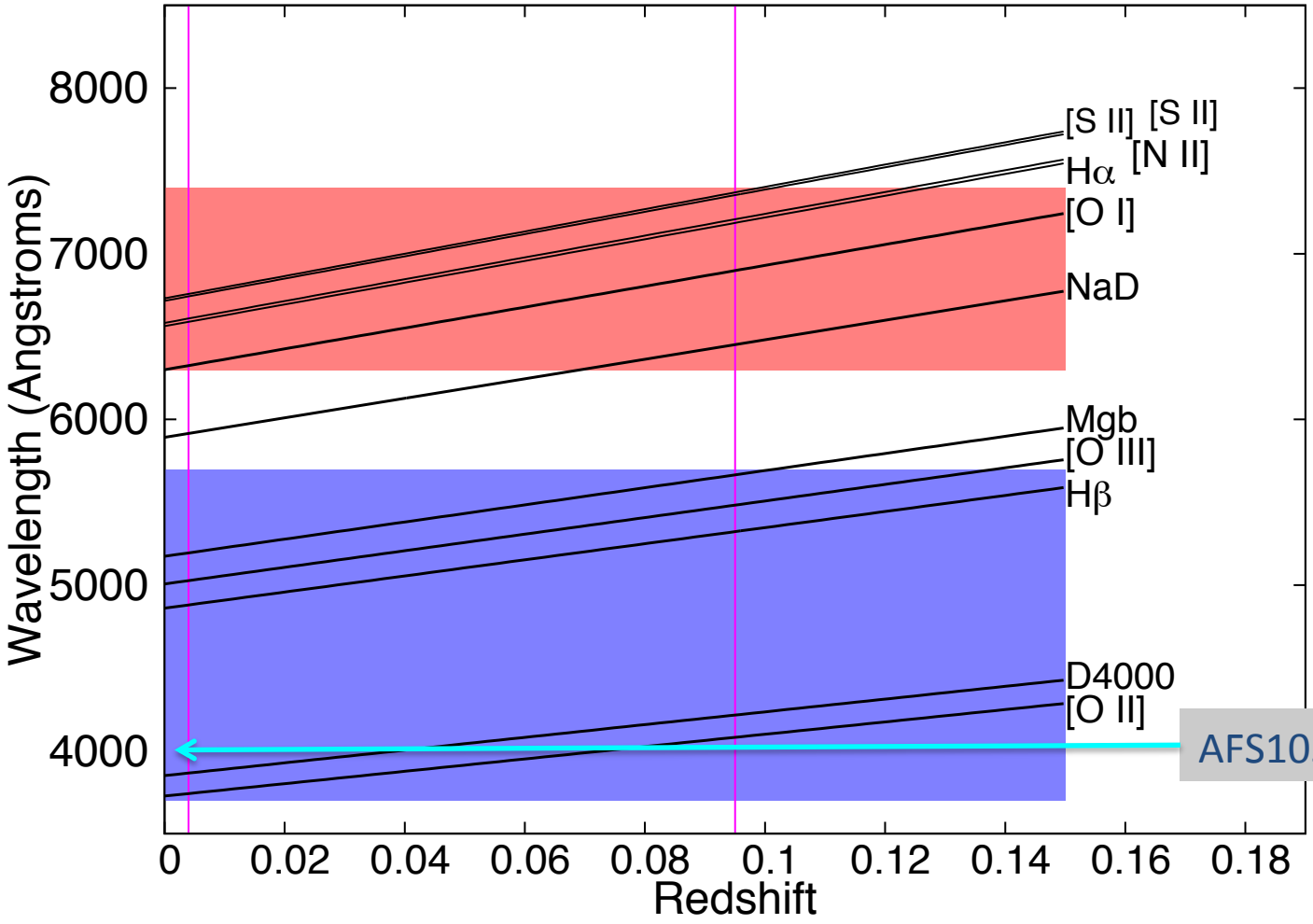


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AFS105/125 60% throughput

WF105/125Y >80%

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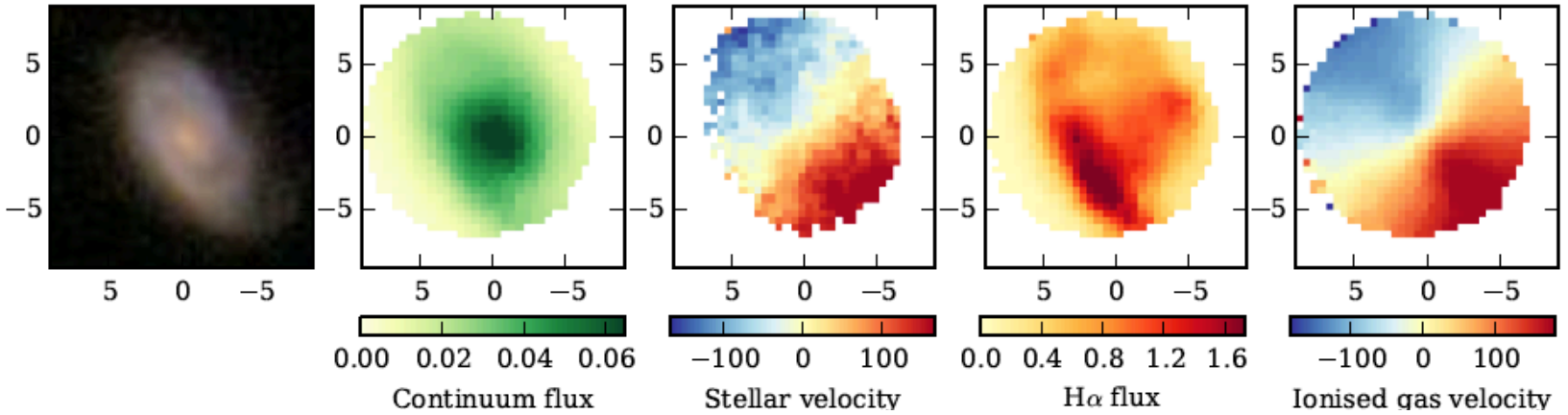
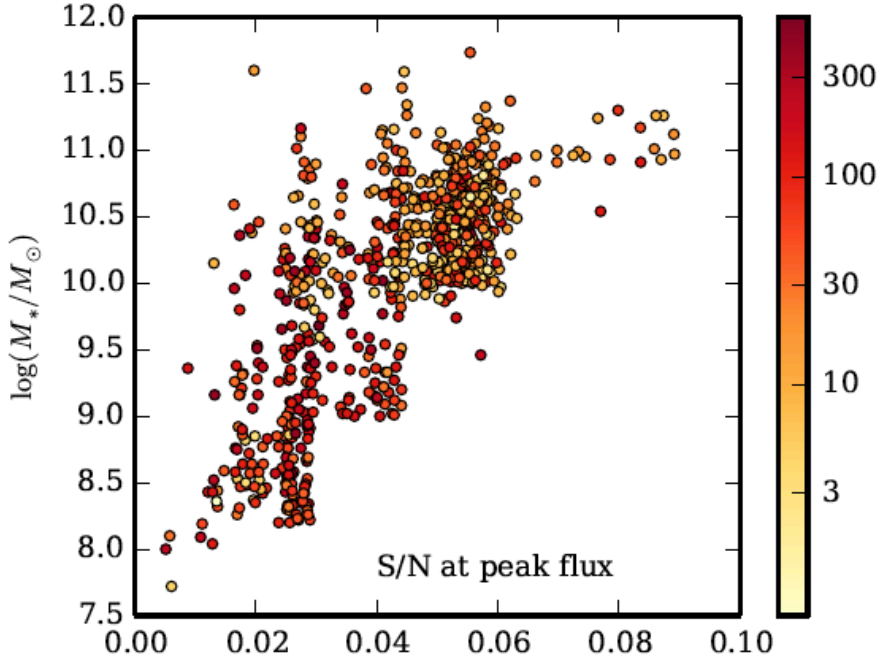
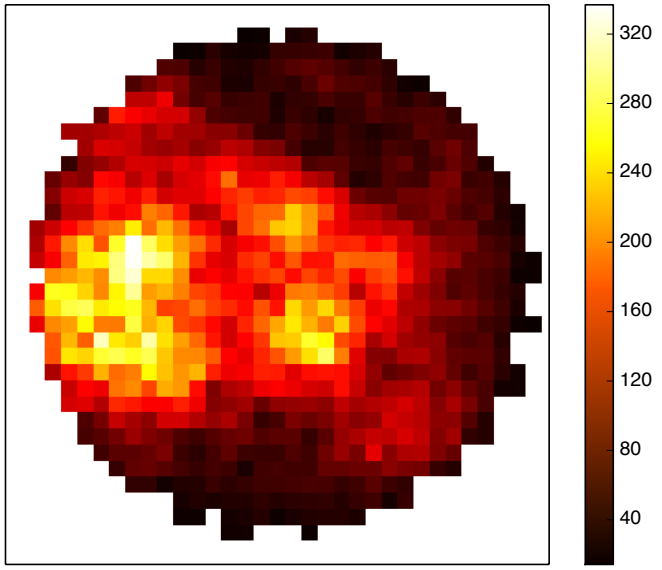
# SAMI Galaxy Survey Galaxy data



Sharp et al. 2014, Allen et al. 2014

Bryant et al. 2014

# Conclusion

## The SAMI instrument:

- **Hexabundles** have been successfully demonstrated on sky.
- The SAMI Galaxy Survey is nearly 1/3$^{rd}$ through with 1000 galaxies observed and 107 in a public data release.
- Minimizing FRD in the hexabundles and fibre cables was the biggest challenge.
- Science papers are now coming out (Fogarty+, Ho+, Sharp+, Allen+, Bryant+, Richards+, Cortese+.....)

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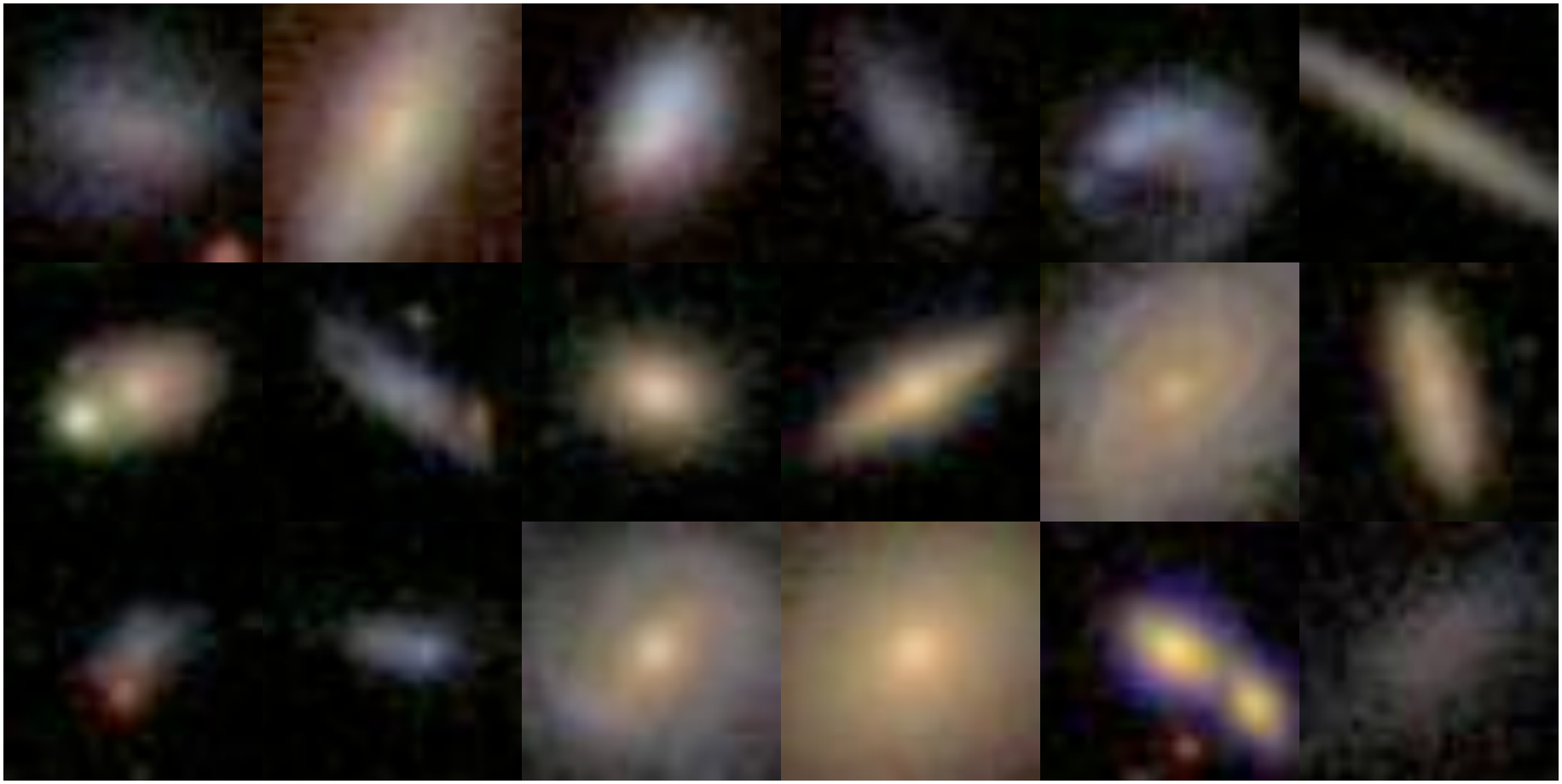

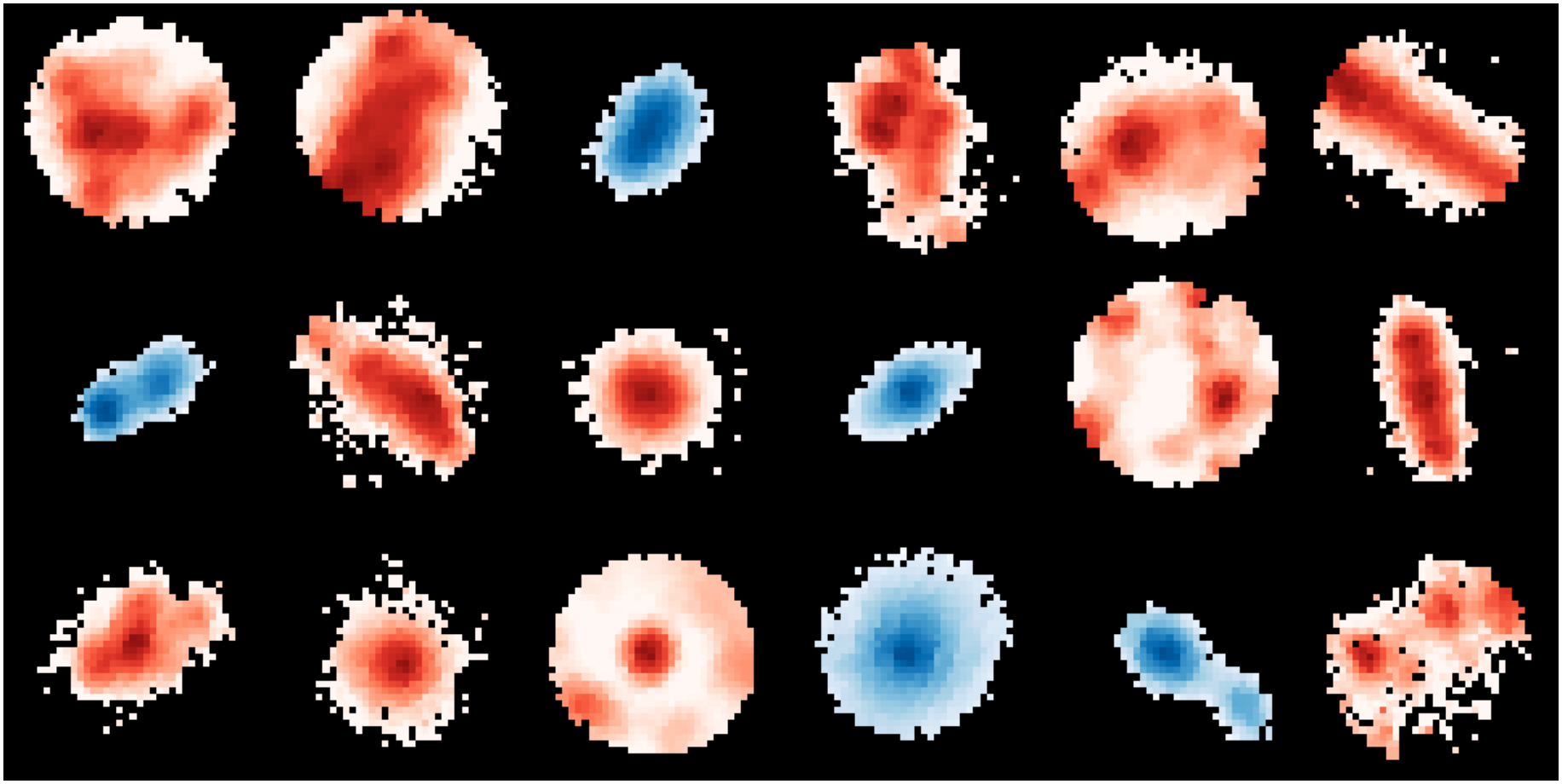

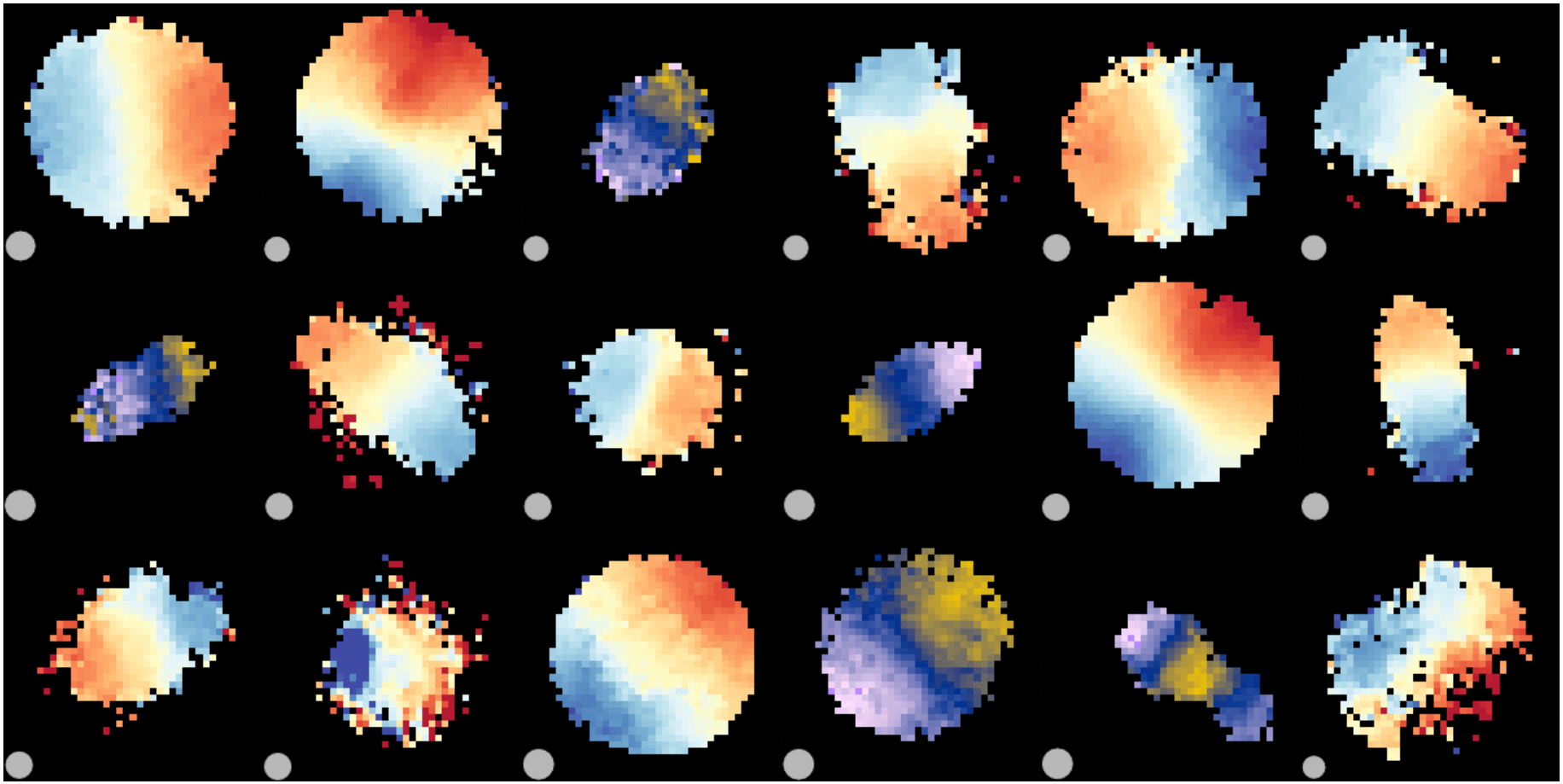

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