



BCG Morphology between HSC and JWST NIRCам data

Anas Yamalae, Mahidol University, Thailand

COSPAR Workshop

BCGs morphology

- BCGs are mostly elliptical
- Searching for spiral BCGs
- Analysis through surface brightness profile and structural parameters
- Use HSC-SSP cluster catalog

THE ASTROPHYSICAL JOURNAL, 930:138 (9pp), 2022 May 10

<https://doi.org/10.3847/1538-4357/ac62cd>

© 2022. The Author(s). Published by the American Astronomical Society.

OPEN ACCESS



Detection of a Superluminous Spiral Galaxy in the Heart of a Massive Galaxy Cluster

Ákos Bogdán¹, Lorenzo Lovisari^{2,1}, Patrick Ogle³, Orsolya E. Kovács^{4,1}, Thomas Jarrett⁵, Christine Jones¹, William R. Forman¹, and Lauranne Lanz⁶

¹ Center for Astrophysics | Harvard & Smithsonian, 60 Garden Street, Cambridge, MA 02138, USA; abogdan@cfa.harvard.edu

² INAF—Osservatorio di Astrofisica e Scienza dello Spazio di Bologna, via Piero Gobetti 93/3, I-40129 Bologna, Italy

³ Space Telescope Science Institute, 3700 San Martin Drive, Baltimore, MD 21218, USA

⁴ Department of Theoretical Physics and Astrophysics, Faculty of Science, Masaryk University, Kotlářská 2, Brno, 611 37, Czech Republic

⁵ Astronomy Department, University of Cape Town, Private Bag X3, Rondebosch 7701, South Africa

⁶ Department of Physics, The College of New Jersey, 2000 Pennington Road, Ewing, NJ 08628, USA

Received 2022 January 27; revised 2022 March 29; accepted 2022 March 29; published 2022 May 12

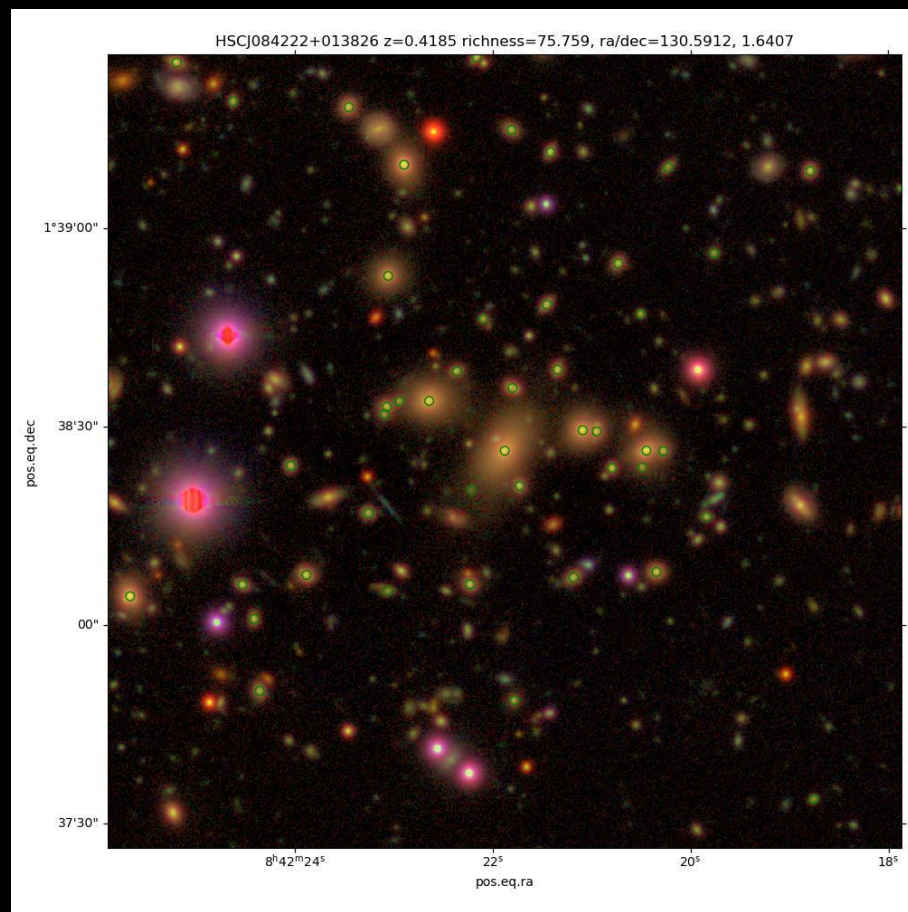
Abstract

It is well established that brightest cluster galaxies (BCGs), residing in the centers of galaxy clusters, are typically massive and quenched galaxies with cD or elliptical morphology. An optical survey suggested that an exotic galaxy population, superluminous spiral and lenticular galaxies, could be the BCGs of some galaxy clusters. Because the cluster membership and the centroid of a cluster cannot be accurately determined based solely on optical data, we followed up a sample of superluminous disk galaxies and their environments using XMM-Newton X-ray observations. Specifically, we explored seven superluminous spiral and lenticular galaxies that are candidate BCGs. We detected massive galaxy clusters around five superluminous disk galaxies and established that one superluminous spiral, 2MASX J16273931+3002239, is the central BCG of a galaxy cluster. The temperature and total mass of the cluster are $kT_{500} = 3.55^{+0.18}_{-0.20}$ keV and $M_{500} = (2.39 \pm 0.19) \times 10^{14} M_{\odot}$. We identified the central galaxies of the four clusters that do not host superluminous disk galaxies at their cores, and established that the centrals are massive elliptical galaxies. However, for two of the clusters, the offset superluminous spirals are brighter than the central galaxies, implying that the superluminous disk galaxies are the *brightest* cluster galaxies. Our results demonstrate that superluminous disk galaxies are rarely the central systems of galaxy clusters. This is likely because galactic disks are destroyed by major mergers, which are more frequent in high-density environments. We speculate that the disks of superluminous disk galaxies in cluster cores may have been reformed due to mergers with gas-rich satellites.

Unified Astronomy Thesaurus concepts: Brightest cluster galaxies (181); Giant galaxies (652); X-ray astronomy (1810); Intracluster medium (858); High energy astrophysics (739); Spiral galaxies (1560); Galaxy clusters (584); Galactic and extragalactic astronomy (563); Extragalactic astronomy (506)

Bogdán et al. (2022)

HSCJ084222+013826 (GAMA-100033, clstr 9800)



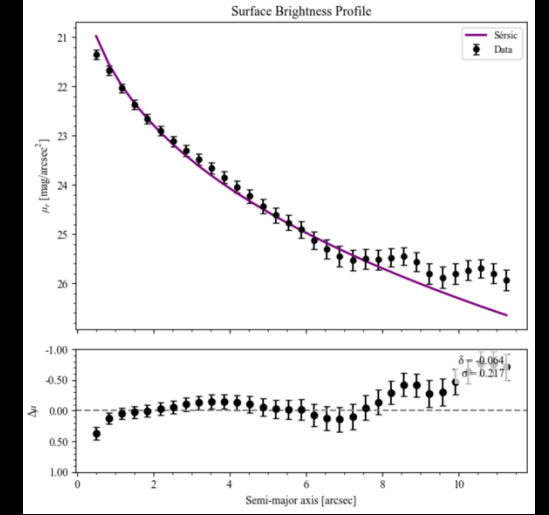
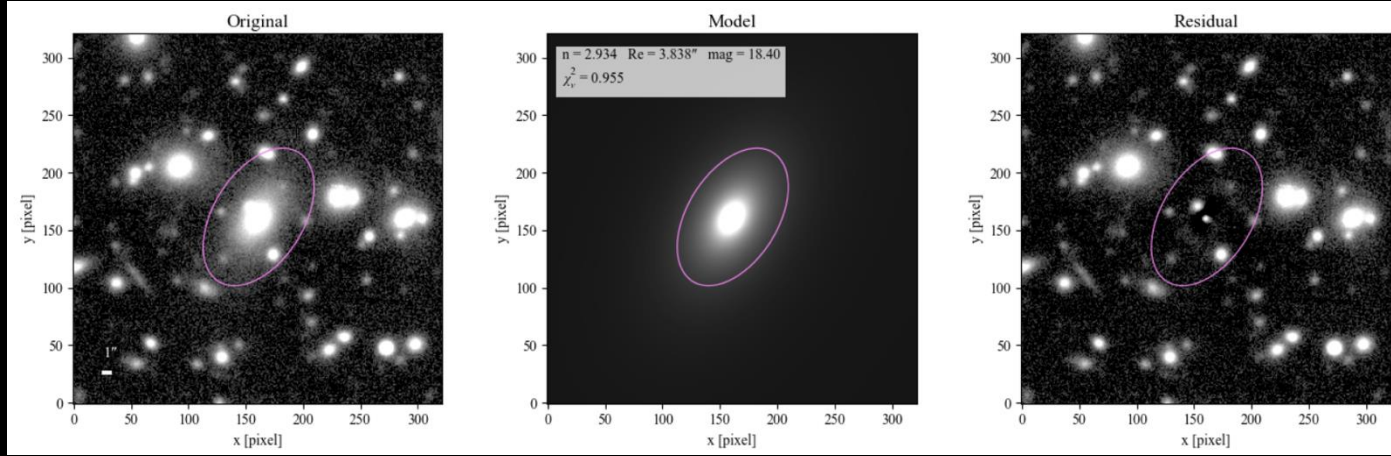
HSC



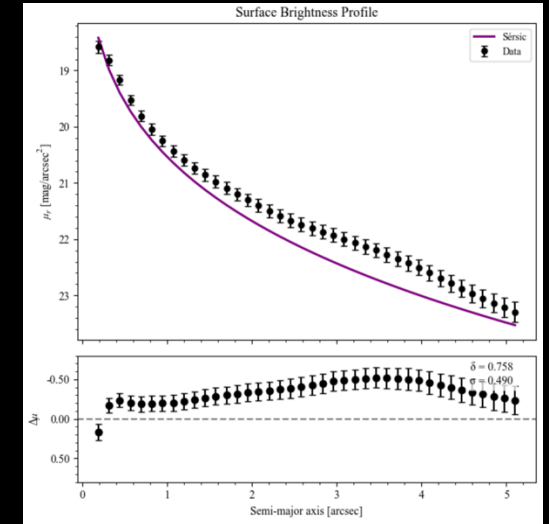
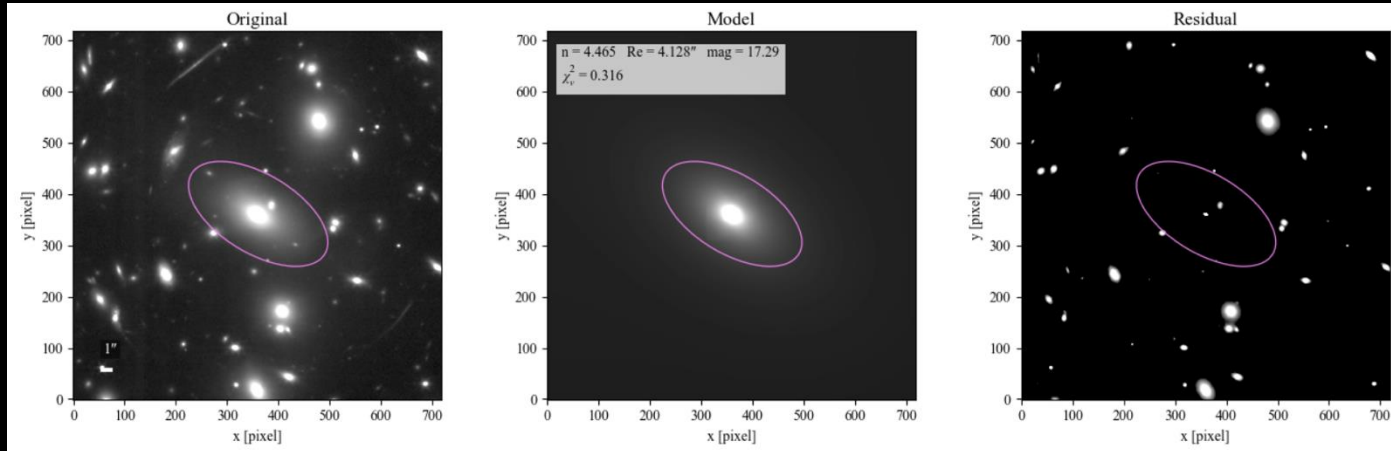
JWST

HSCJ084222+013826 (GAMA-100033, clstr 9800): GALFIT

HSC-R



JWST-F444W



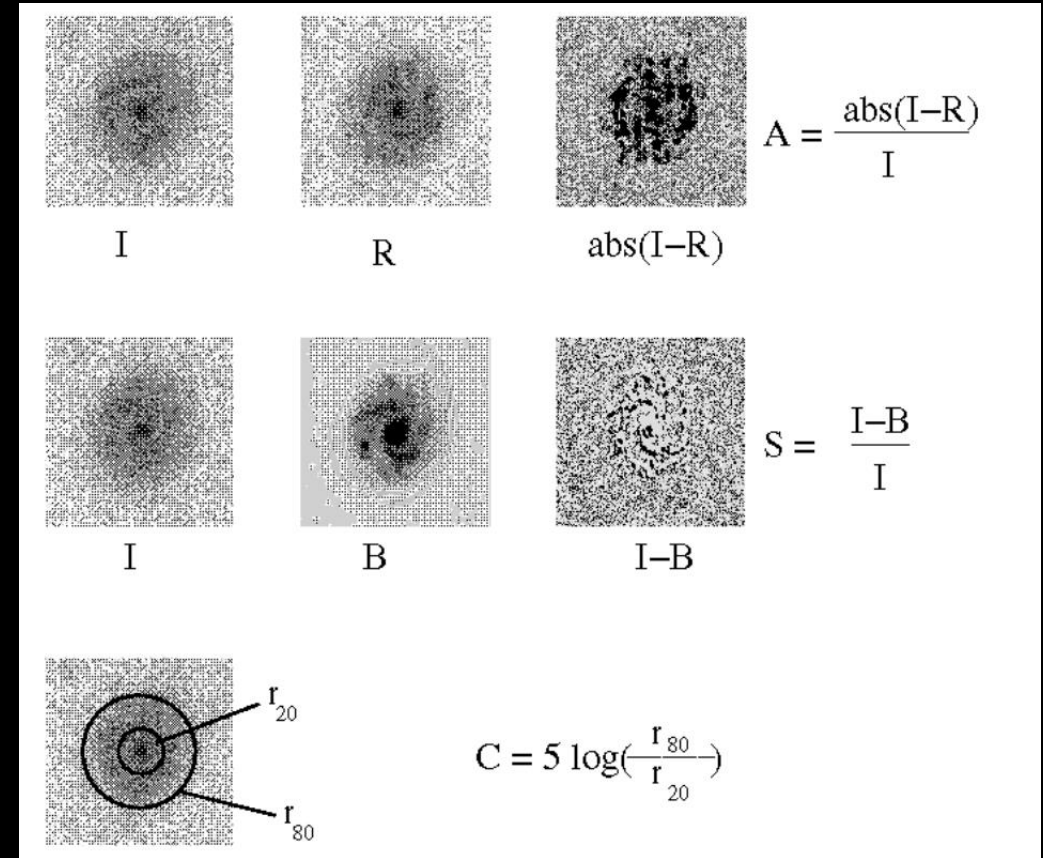
Structural parameters

- Concentration (C)
- Asymmetry (A)
- Smoothness (S)

TABLE 6

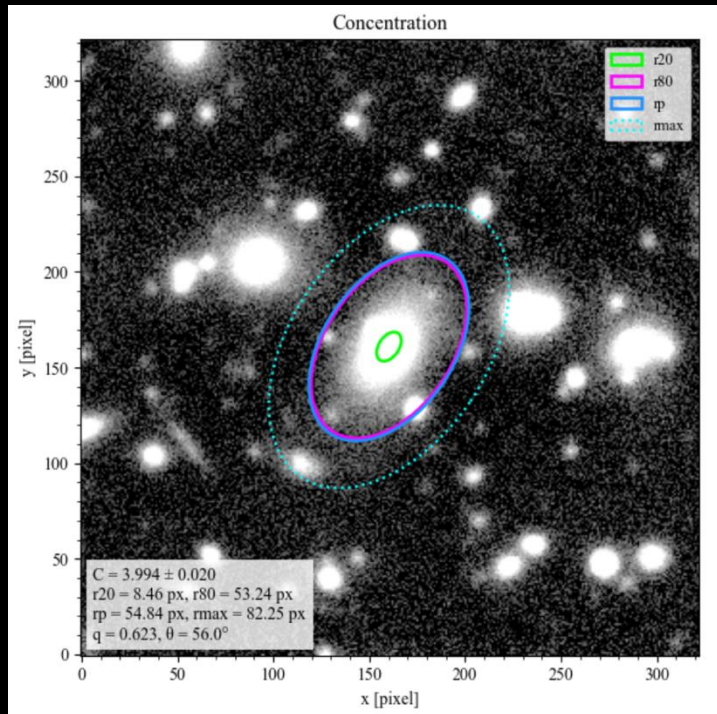
AVERAGES AND 1σ VARIATIONS OF STRUCTURAL PARAMETERS FOR GALAXY TYPES

Type	$C(R)$	$A(R)$	$S(R)$
Ellipticals	4.4 ± 0.3	0.02 ± 0.02	0.00 ± 0.04
Early-Type Disks (Sa - Sb)	3.9 ± 0.5	0.07 ± 0.04	0.08 ± 0.08
Late-Type Disks (Sc - Sd)	3.1 ± 0.4	0.15 ± 0.06	0.29 ± 0.13
Irregulars	2.9 ± 0.3	0.17 ± 0.10	0.40 ± 0.20
Edge-On Disks	3.7 ± 0.6	0.17 ± 0.11	0.45 ± 0.20
ULIRGs	3.5 ± 0.7	0.32 ± 0.19	0.50 ± 0.40
Starbursts	2.7 ± 0.2	0.53 ± 0.22	0.74 ± 0.25
Dwarf Ellipticals	2.5 ± 0.3	0.02 ± 0.03	0.00 ± 0.06

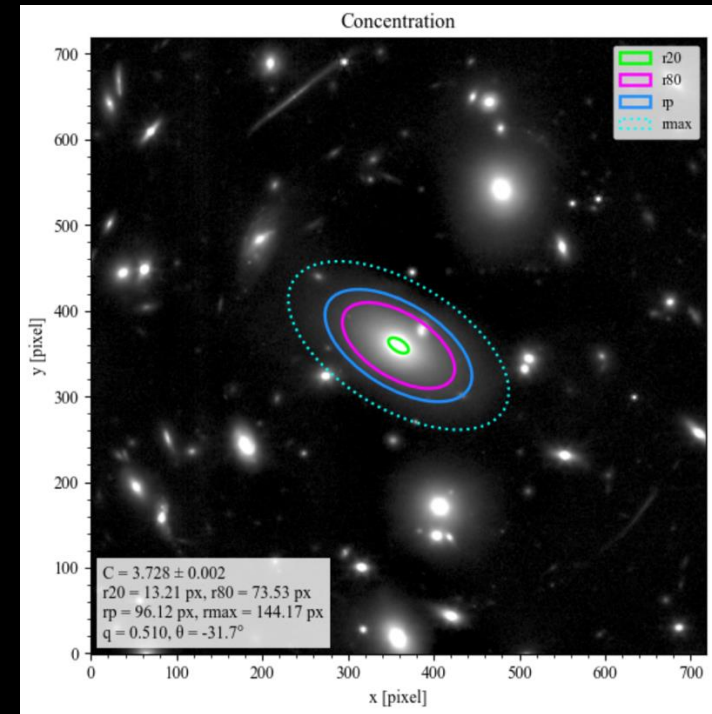


Conselice (2003)

HSCJ084222+013826 (GAMA-100033, clstr 9800): Concentration



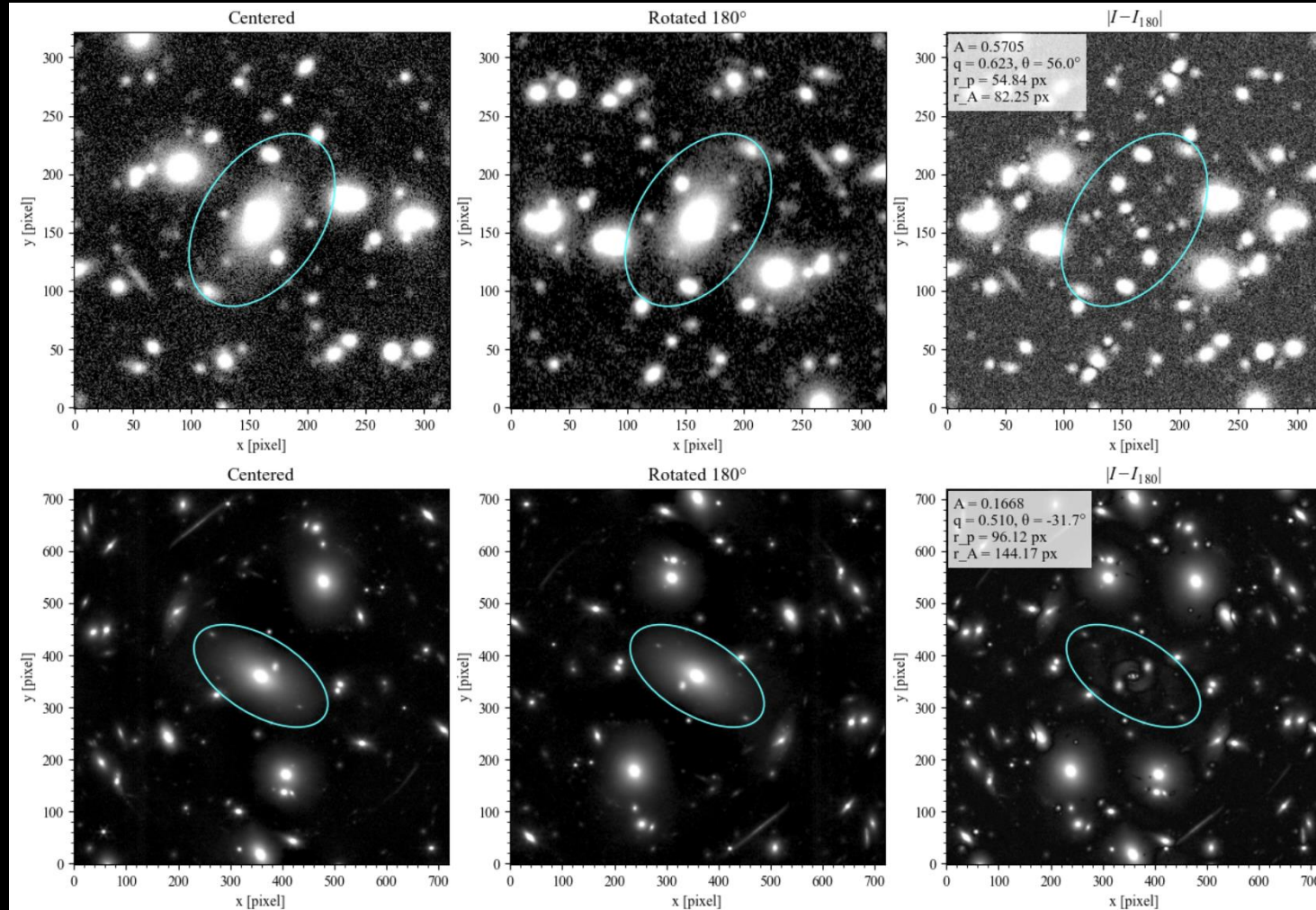
HSC-R



JWST-F444W

HSCJ084222+013826 (GAMA-100033, clstr 9800): Asymmetry

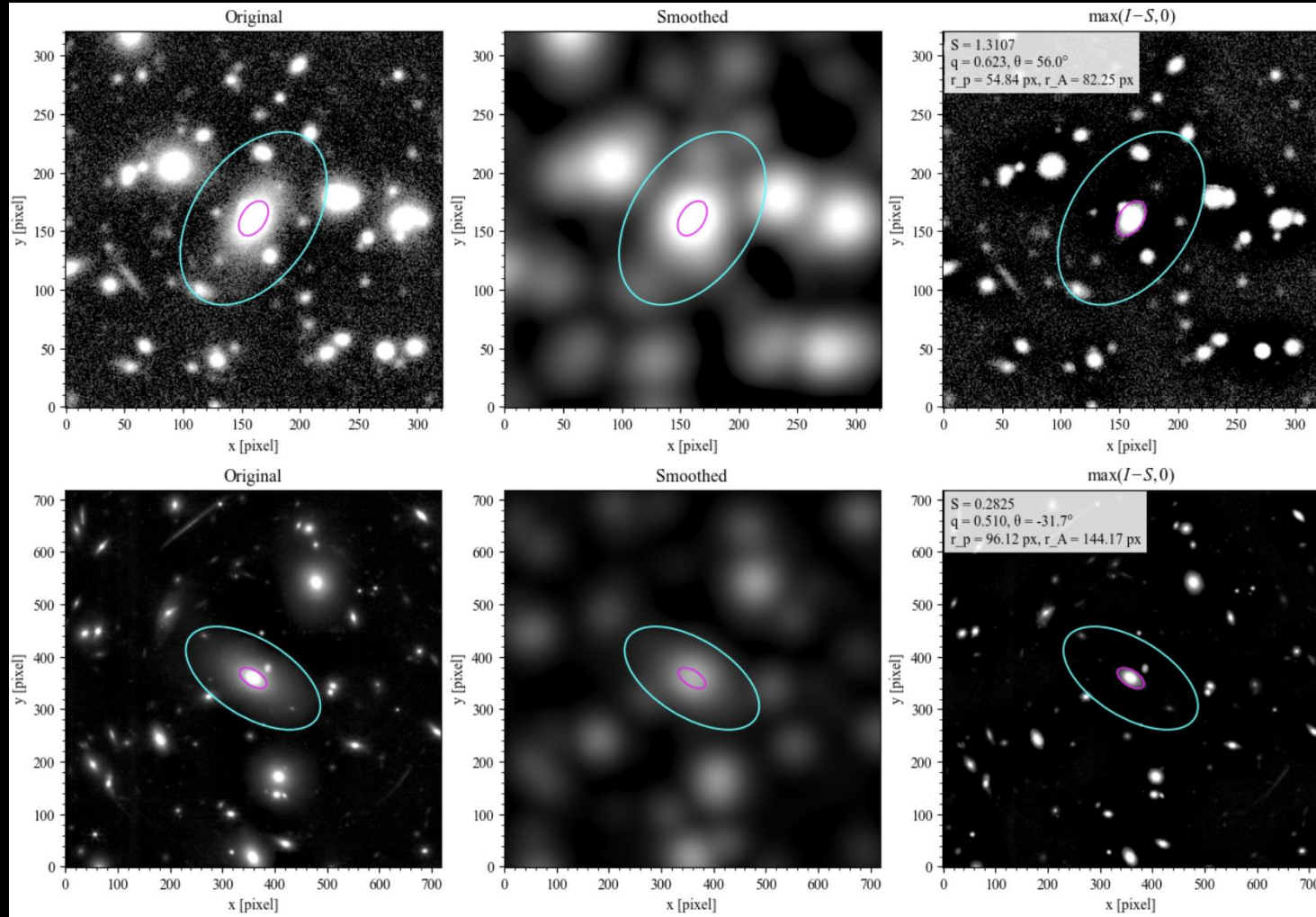
HSC-R



JWST-F444W

HSCJ084222+013826 (GAMA-100033, clstr 9800): Smoothness

HSC-R



JWST-F444W



Thank You