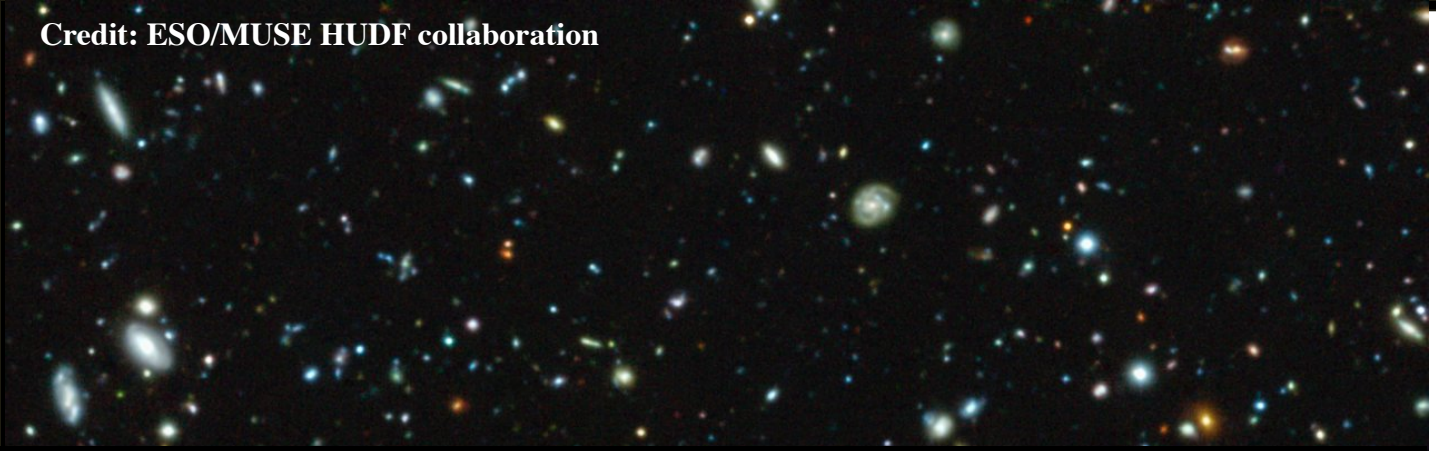


Alla ricerca di buchi neri classificando le galassie

Anna Feltre

SISSA

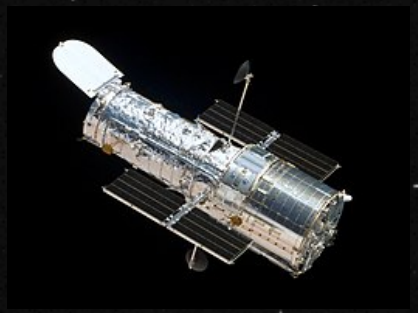
https://github.com/feltre/CPIT3

ITALIA campus party

Hubble Deep Field

TELESCOPIO
SPAZIALE HUBBLE

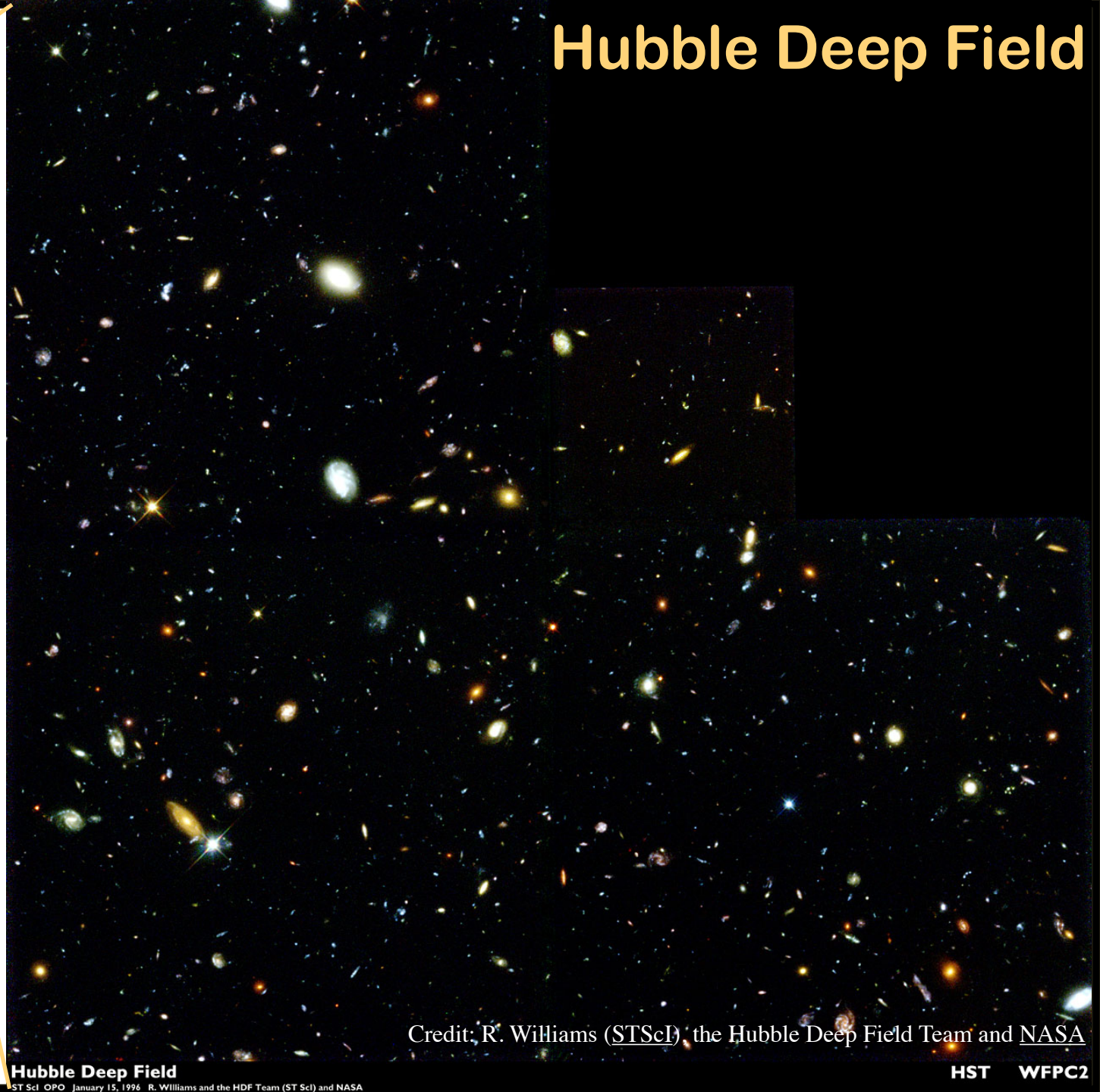
1996



Credit: R. Williams (STScI), the Hubble Deep Field Team and NASA

Hubble Deep Field

1996



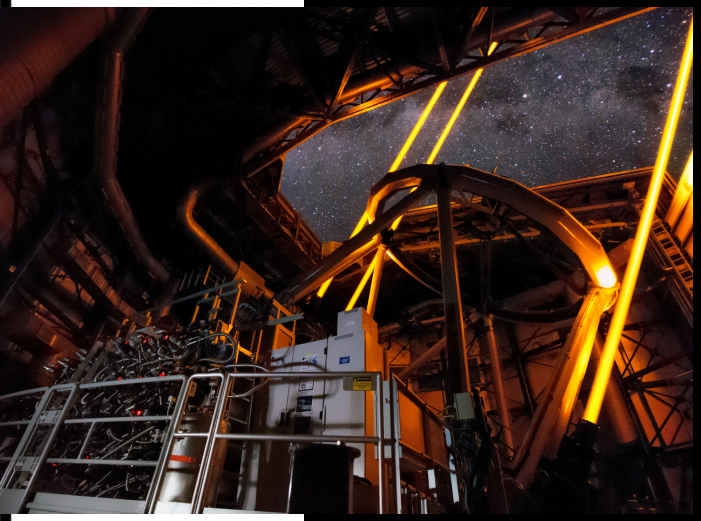
Credit: R. Williams (STScI), the Hubble Deep Field Team and NASA

Hubble Ultra Deep Field

2004

NASA, ESA, S. Beckwith, M. Stiavelli, A. Koekemoer (STScI), R. Thompson (University of Arizona), and the STScI HUDF Team

Credit: ESO/Mark Swinbank, Institute for Computational Cosmology, Durham University

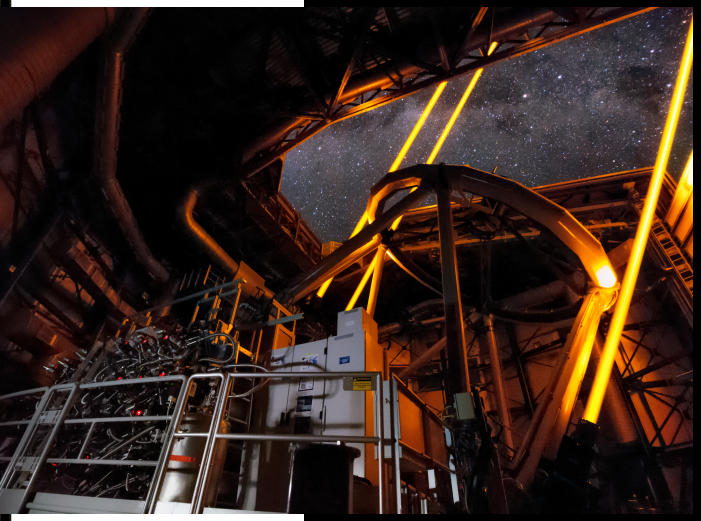


2017

muse
multi unit spectroscopic explorer

ESO

Credit: ESO/Mark Swinbank, Institute for Computational Cosmology, Durham University



2017

muse
multi unit spectroscopic explorer

ESO

Domande aperte

Come si formano le galassie?

Come differiscono le galassie vicine da quelle lontane?

Come si formano i buchi neri super-massicci?

Che effetto hanno i buchi neri sulla galassia che li ospita?

Cosa vedremo oggi

https://github.com/feltre/CPIT3

Cos'e' una galassia

Diversi tipi di galassie e loro classificazione

Come si osservano le galassie

Come si identifica un buco nero "attivo" all'interno delle galassie

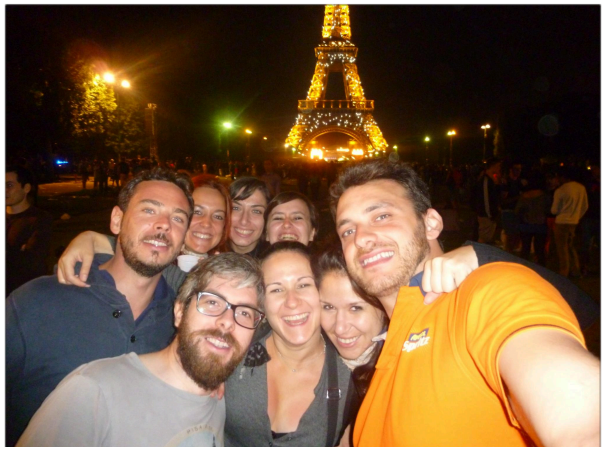
Padova

La Specola Padova -
Dipartimento di Fisica e Astronomia

Phd Students and Postdoctoral Fellows
2012 - European Southern Observatory ESO

Monaco

Padova



Champ de Mars - Parigi, 14 Luglio 2014

Quai Courmont - Lione, April e2018

Monaco

Parigi

Padova

Lione

Pennsylvania

Texas

Svezia, UK,
Spagna, Olanda

Armenia

Cina

Chile

SISSA

Journal Club - Settore Astrofisica
Gennaio 2019

Matematica

Neuroscienze

Fisica

Laboratorio interdisciplinare

Oltre la Via Lattea

Credit: G. Hüdepohl (atacamaphoto.com)/ESO

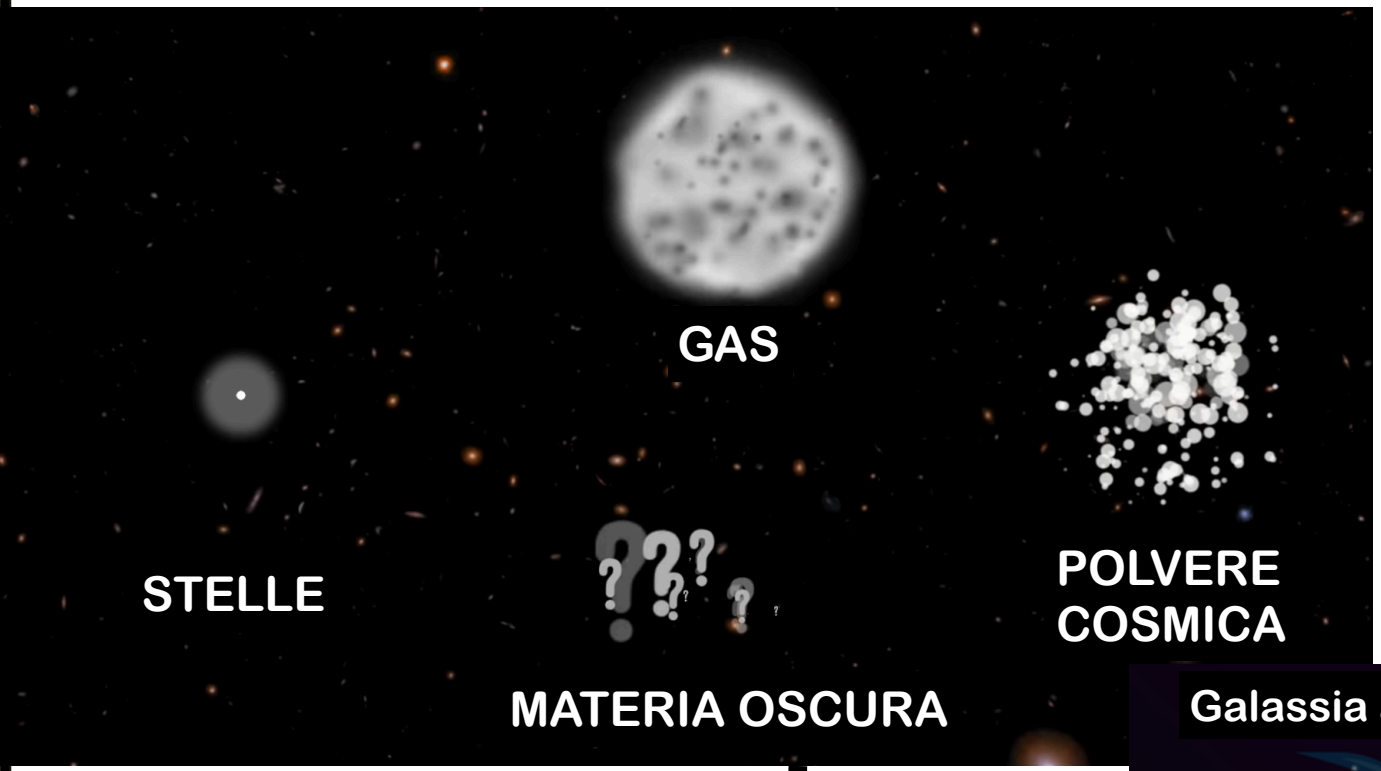
Oltre la Via Lattea

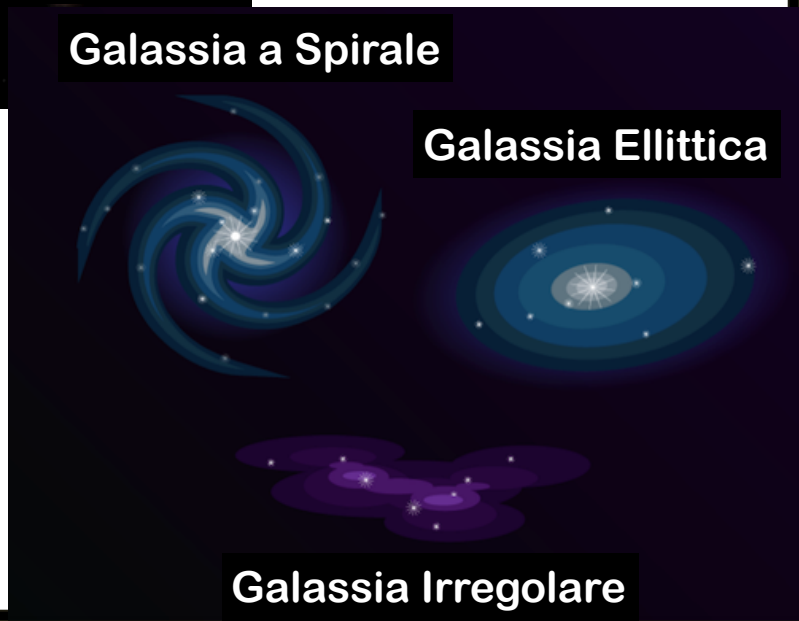
M31 - Adromeda

Credit: G. Hüdepohl (atacamaphoto.com)/ESO

Oltre la Via Lattea

Cos’é una galassia ?





Esercizio 1
…classifichiamo le galassie!

https://www.zooniverse.org/projects/zookeeper/galaxy-zoo

Get started ↓

Choose 'Enhanced' to see those galaxies we most need your help with. Choose 'Classic' for a random selection.

Classic | Enhanced

https://github.com/feltre/CPIT3

Esercizio 1
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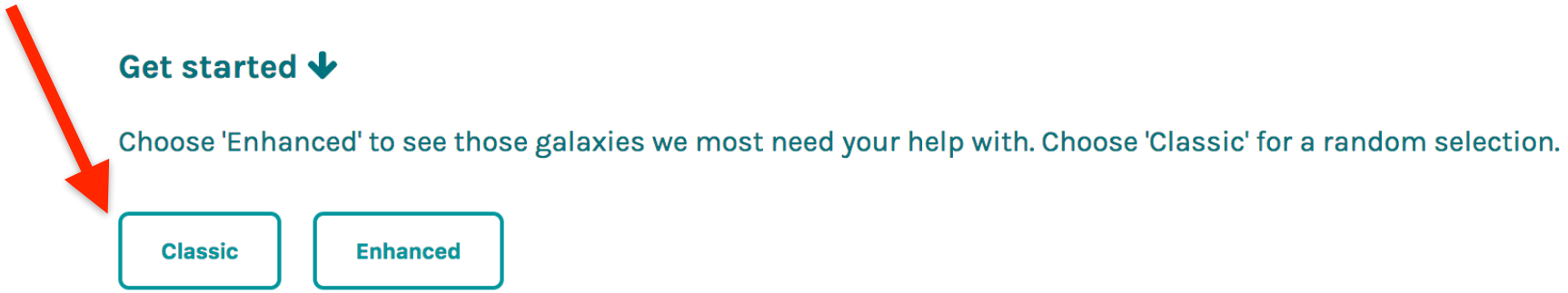
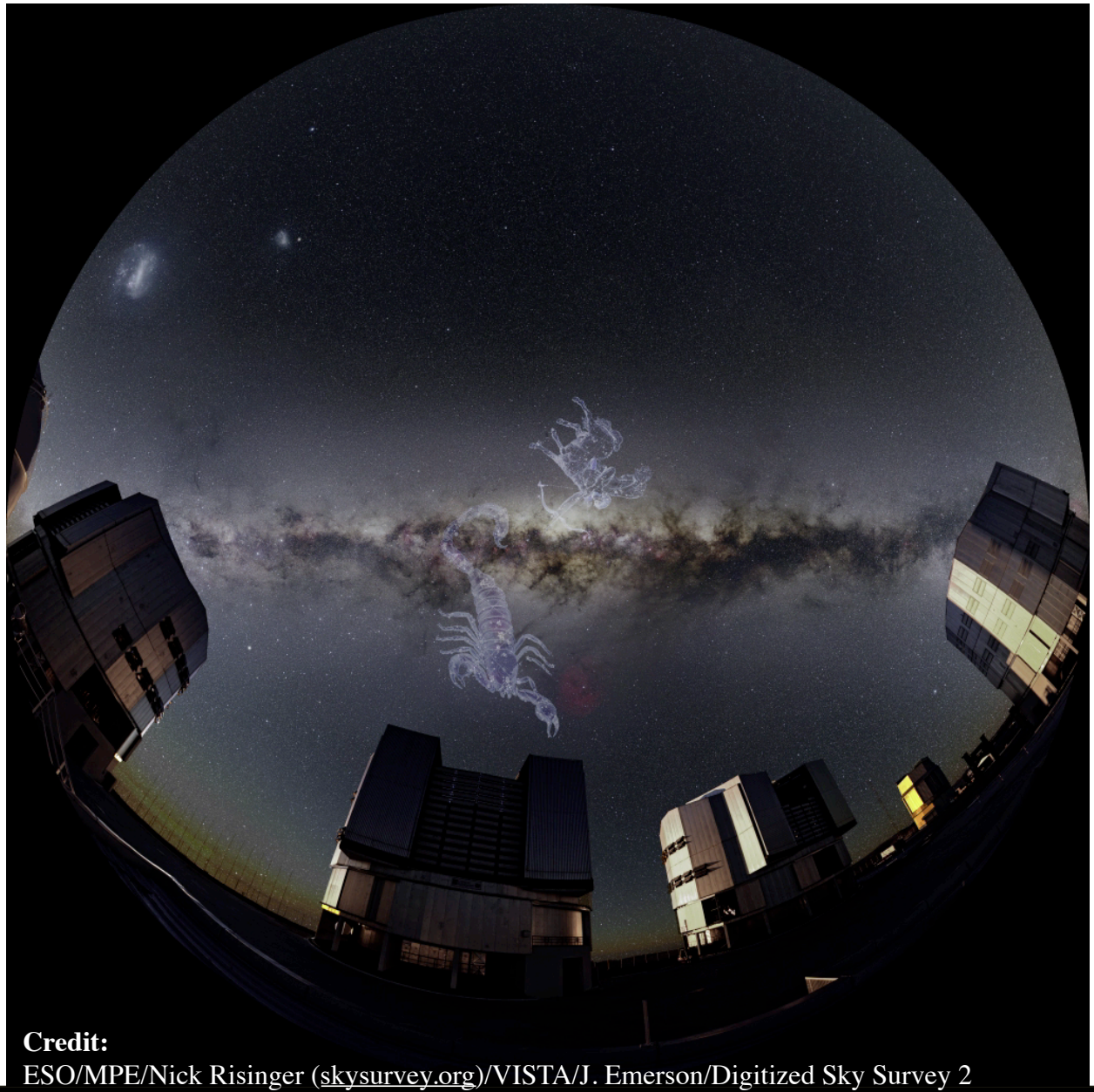


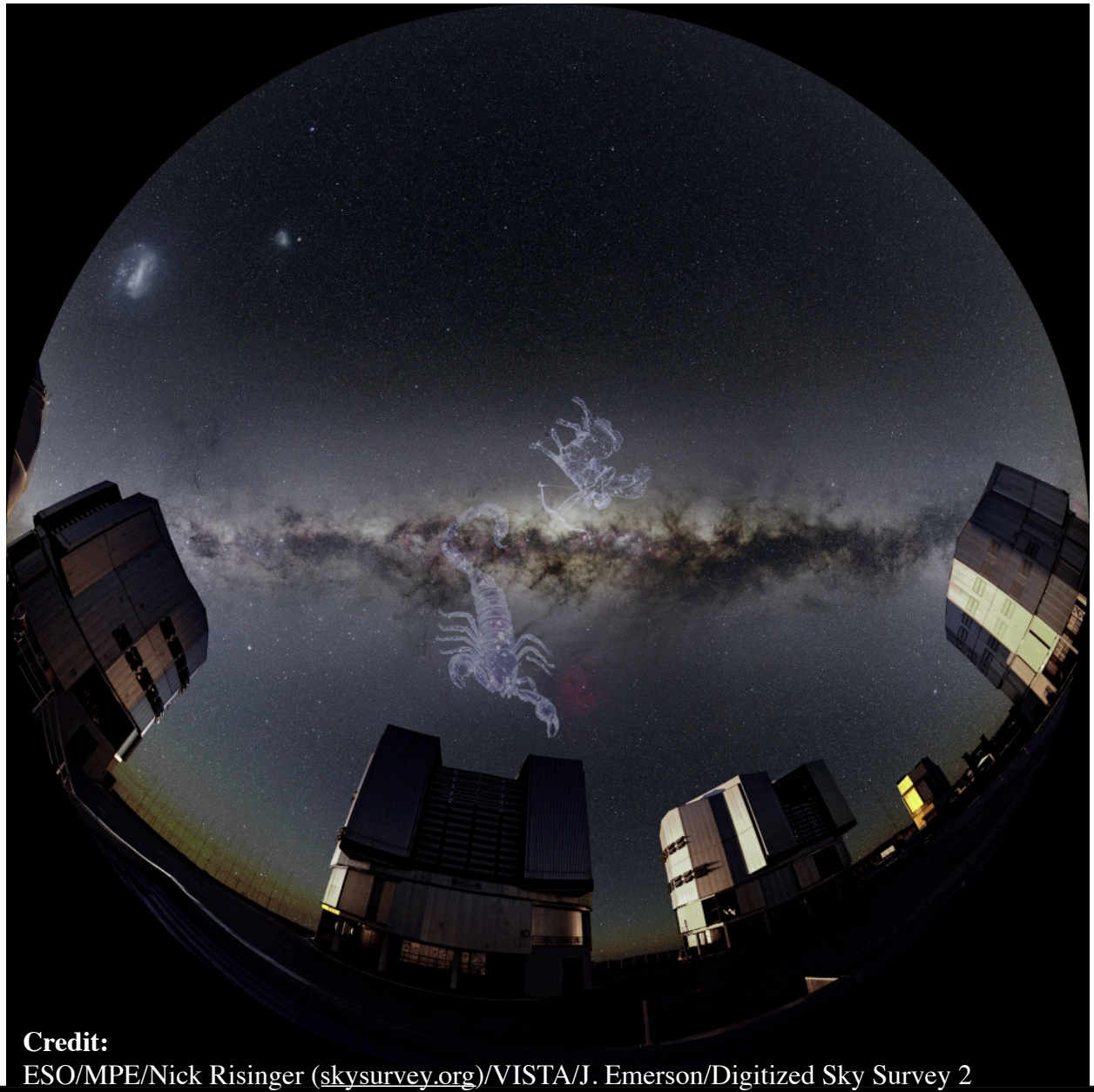
https://github.com/feltre/CPIT3

Cosa c’é al centro delle galassie?



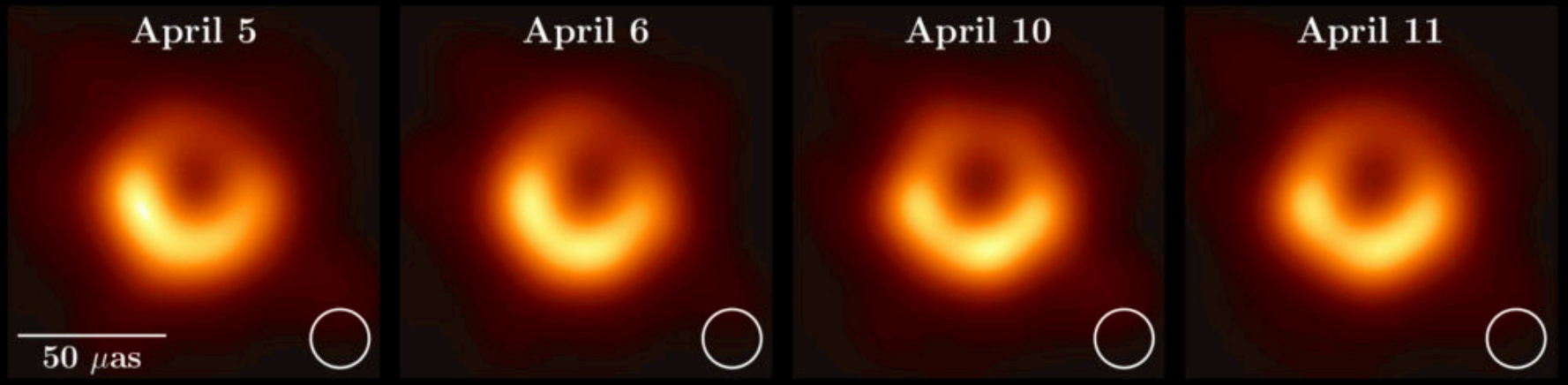
Credit:
ESO/MPE/Nick Risinger (skysurvey.org)/VISTA/J. Emerson/Digitized Sky Survey 2

Cosa c’é al centro delle galassie?



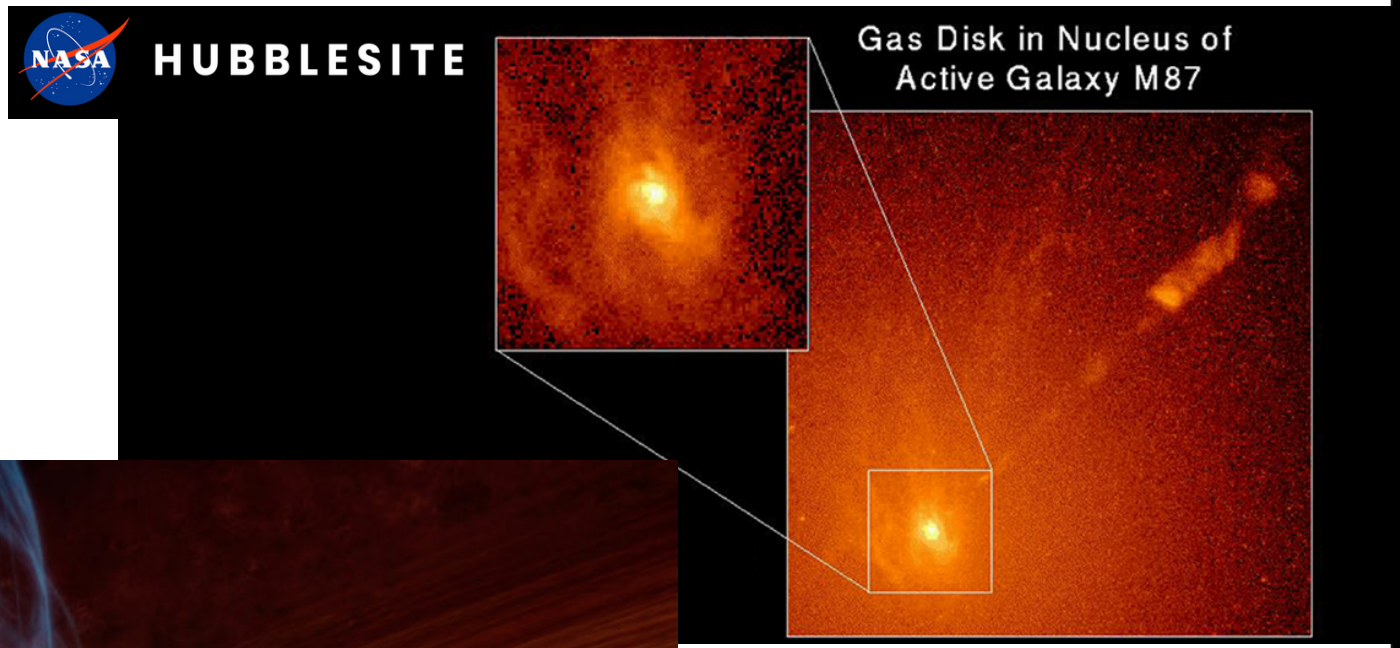
Credit:
ESO/MPE/Nick Risinger (skysurvey.org)/VISTA/J. Emerson/Digitized Sky Survey 2

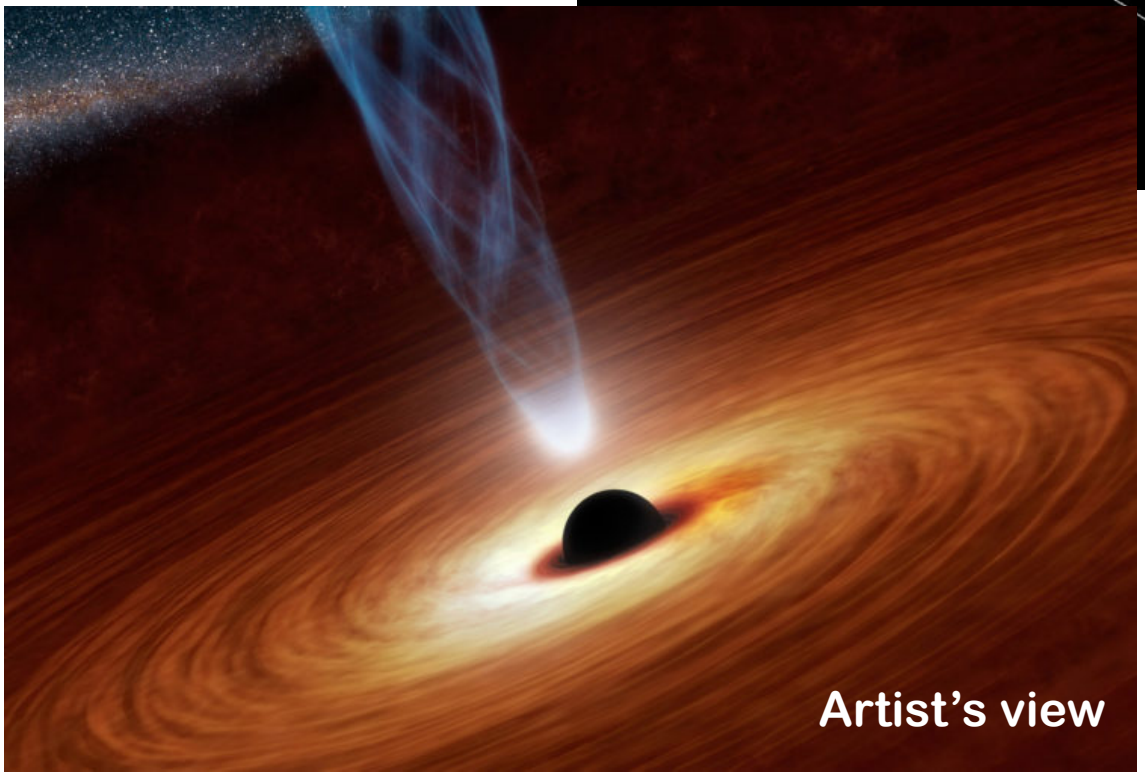
Buchi neri super massicci



Osservazioni da parte di "Event Horizon Telescope" di un buco nero super-massiccio al centro della galassia ellittica M87 [EHT Collaboration et al 2019]

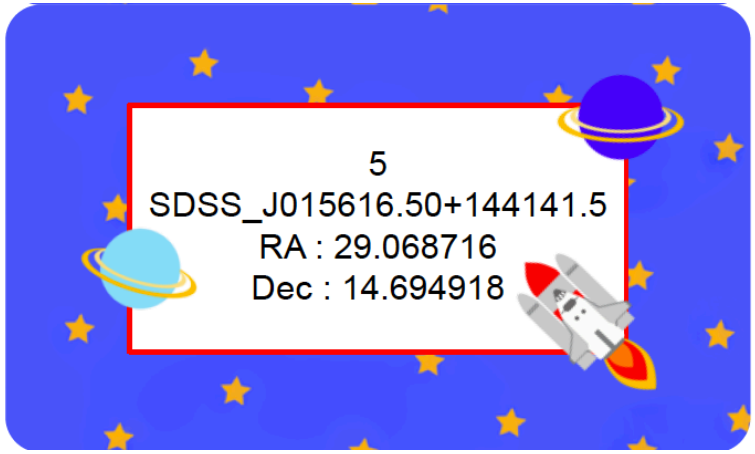
Nuclei Galattici Attivi / Quasars

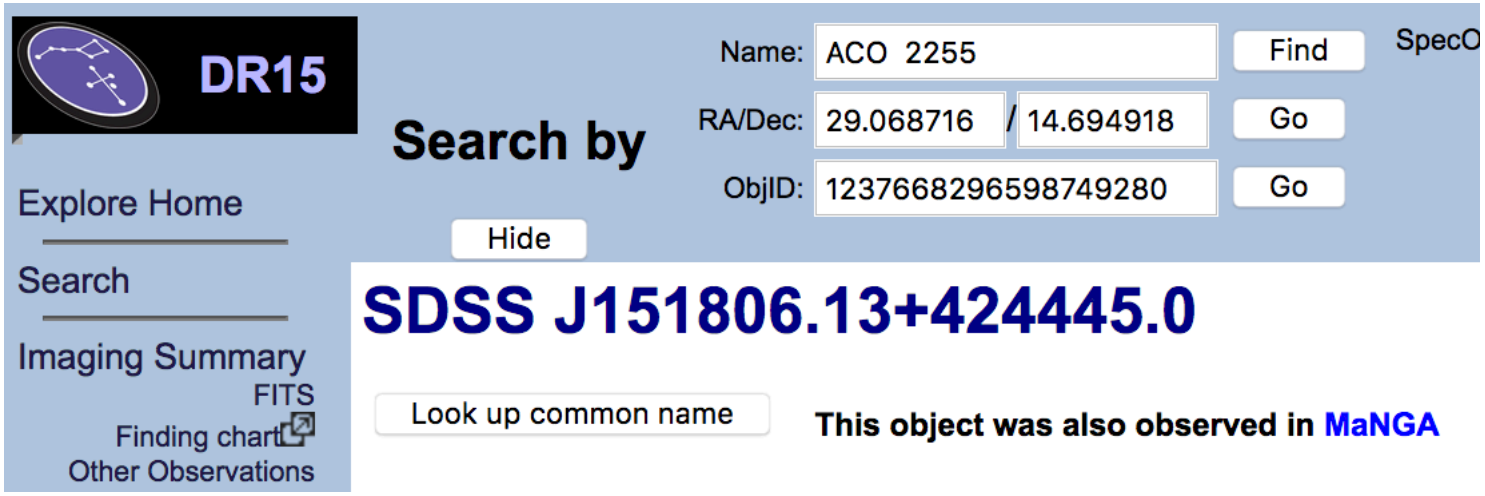




Esercizio 2
… selezioniamo i nuclei galattici attivi!

http://skyserver.sdss.org/dr15/en/tools/explore/





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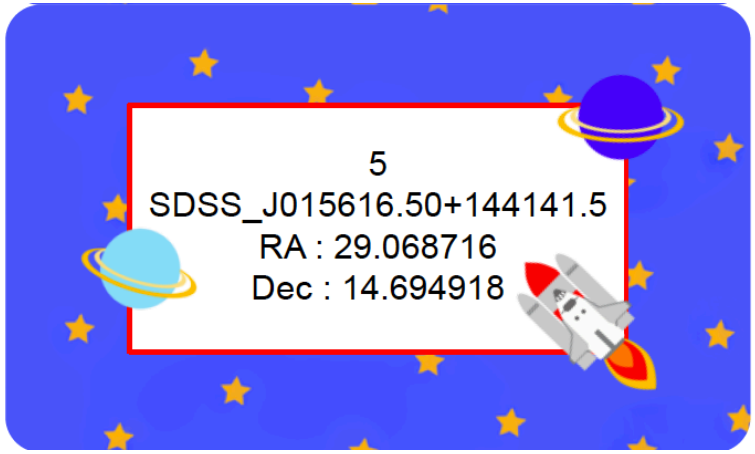
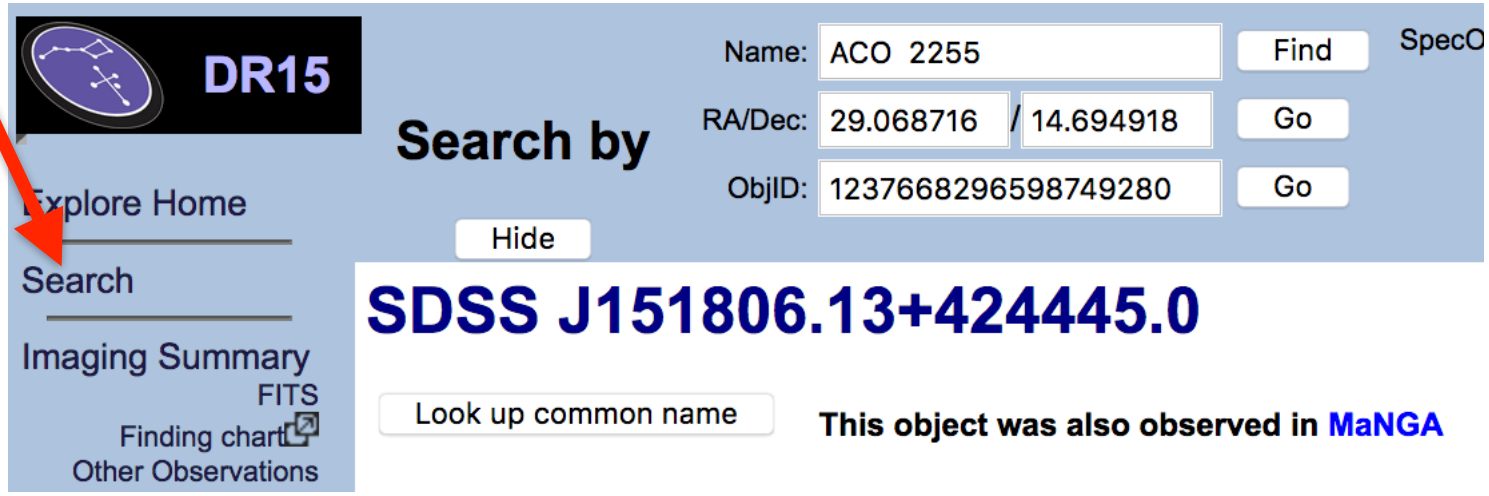


1



https://github.com/feltre/CPIT3

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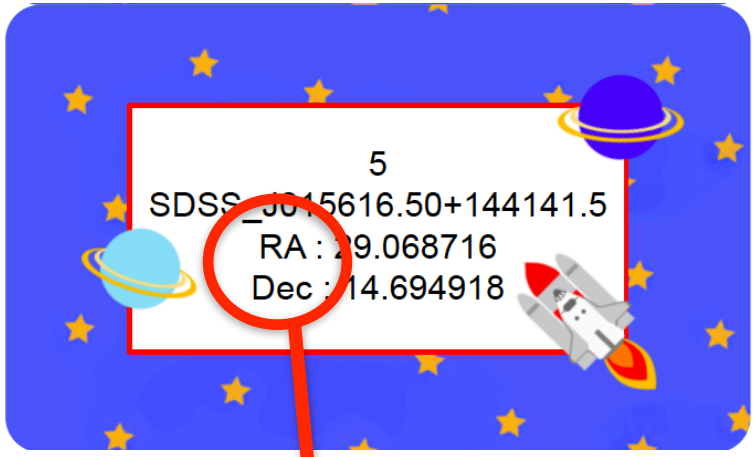

1

2

DR15

Search by

Name: ACO 2255 Find

RA/Dec: 29.068716 / 14.694918 Go

ObjID: 1237668296598749280 Go

Explore Home

Search

Imaging Summary

FITS

Finding chart

Other Observations

Hide

SDSS J151806.13+424445.0

Look up common name

This object was also observed in MaNGA

https://github.com/feltre/CPIT3

Esercizio 2

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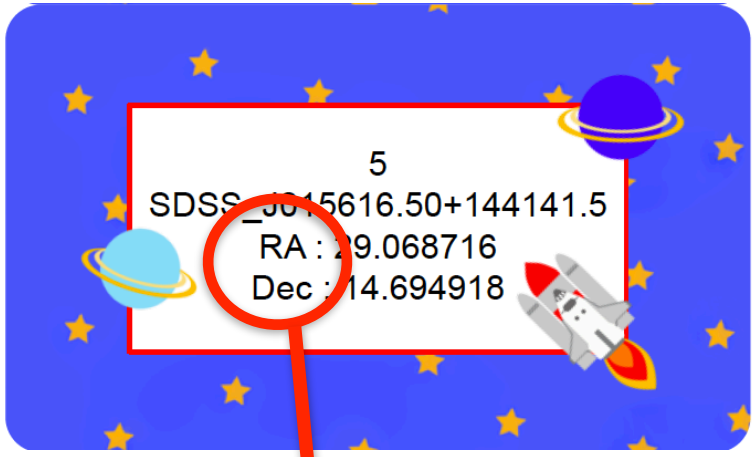

1

2

3

DR15

Search by

Name: ACO 2255 Find

RA/Dec: 29.068716 / 14.694918 Go

ObjID: 1237668296598749280 Go

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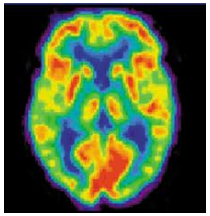
https://github.com/feltre/CPIT3

Spettro elettromagnetico

PET



Scanner Areoporto

raggi UV del sole

telecomando TV

forno microonde

radio

raggi gamma

raggi X

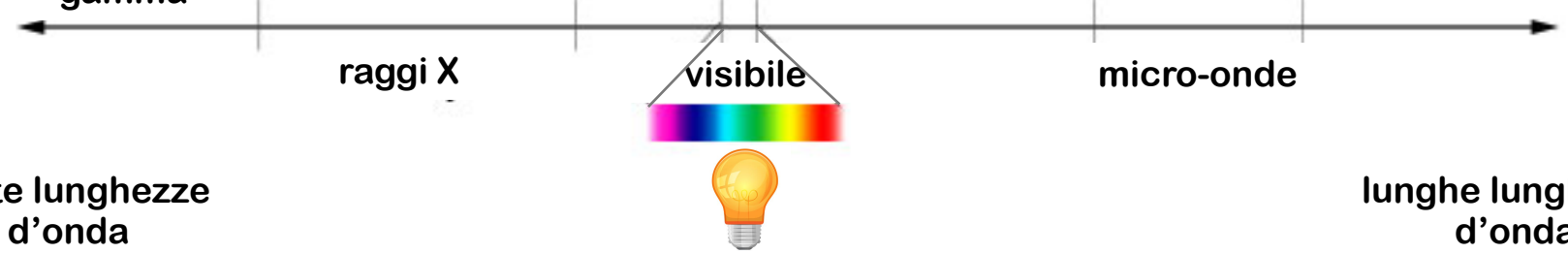
ultravioletto

visibile

infrarosso

micro-onde

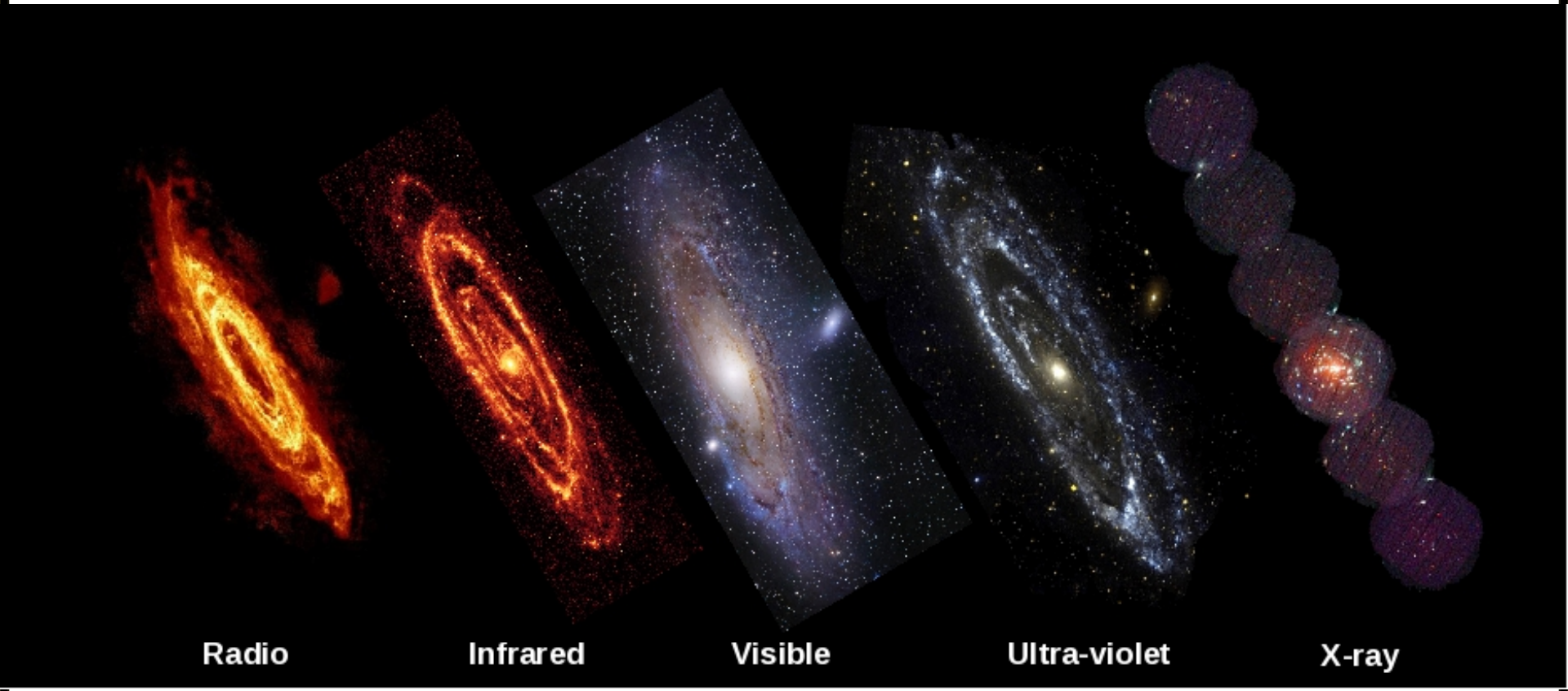
radio



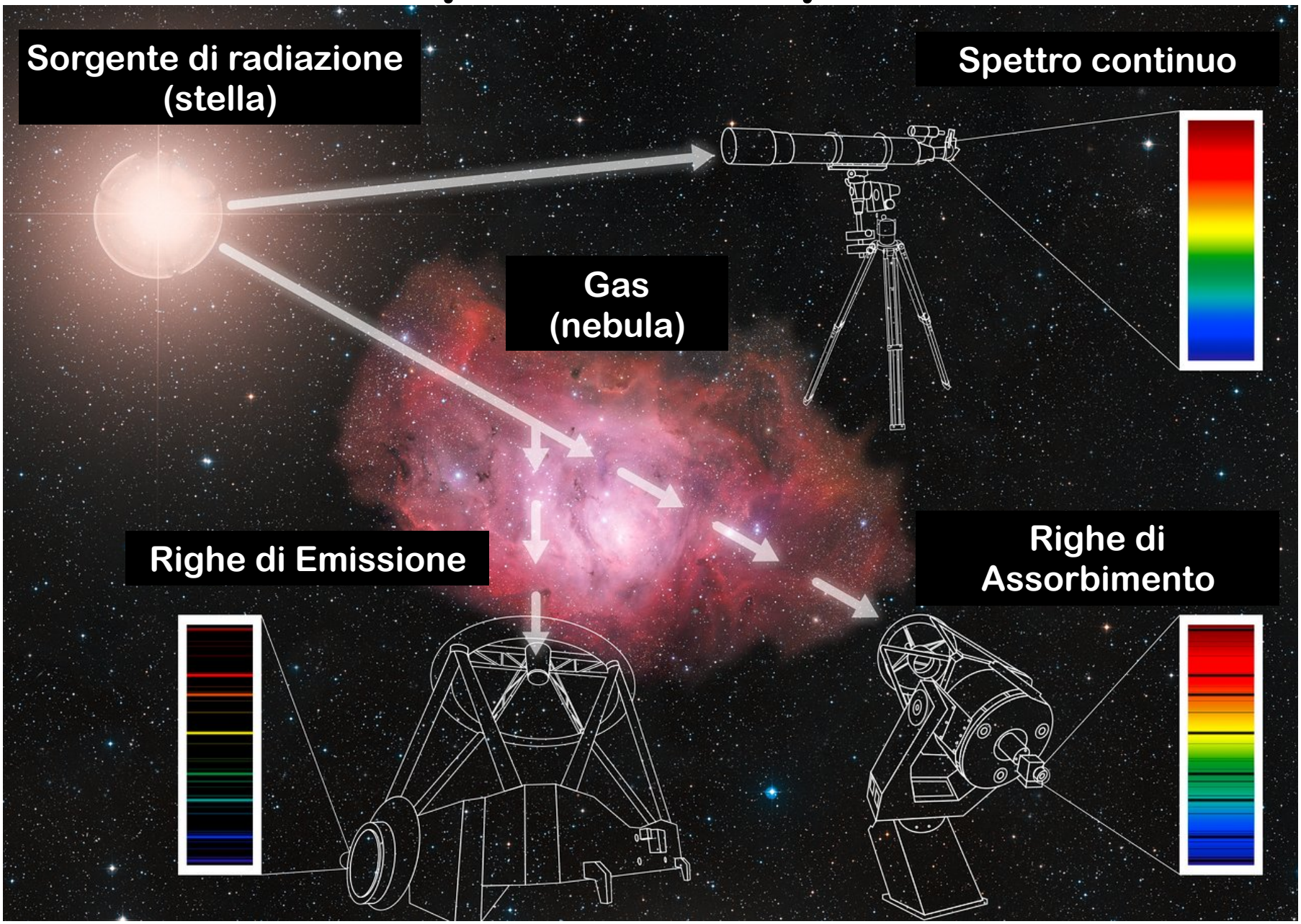
corte lunghezze d'onda
alta frequenza
alta energia

lunghe lunghezze d'onda
bassa frequenza
bassa energia

Osservare a diverse frequenze



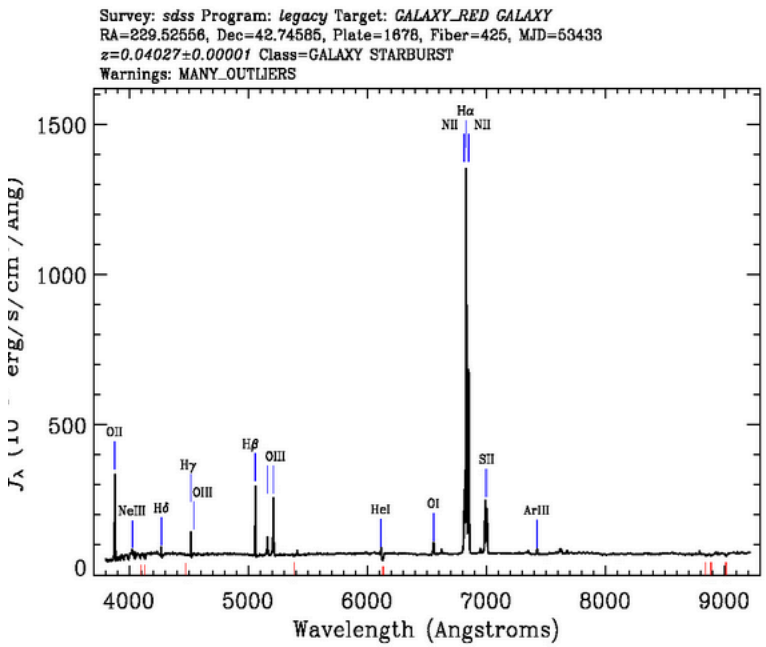
Spettroscopia



Esercizio 2
… selezioniamo i nuclei galattici attivi!

Optical Spectra SpecObjID = 1889376924388583424

Interactive spectrum



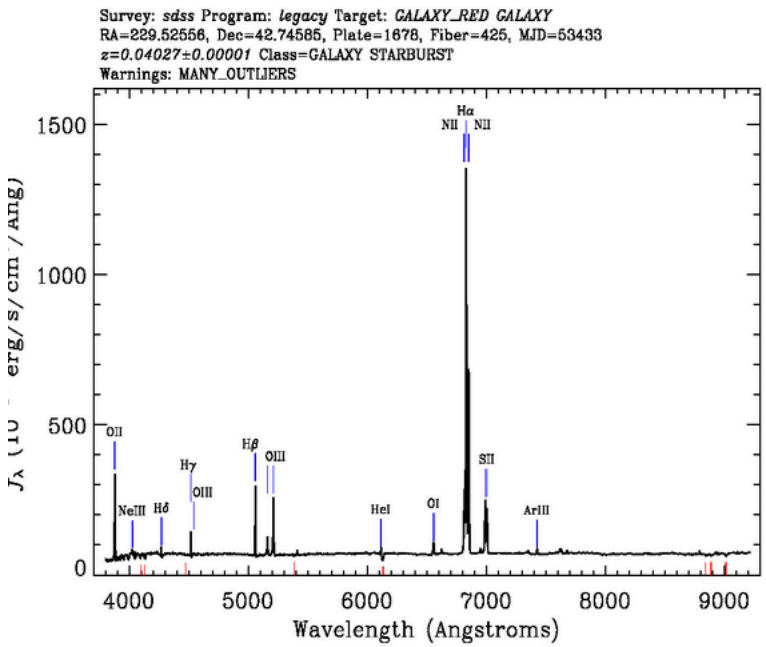
Spectrograph	SDSS
class	GALAXY
Redshift (z)	0.040
Redshift error	0.00001
Redshift flags	MANY_OUTLIERS
survey	sdss
programname	legacy
primary	1
Other spec	0
sourcetype	GALAXY
Velocity dispersion (km/s)	241.21
veldisp_error	7.496
targeting_flags	GALAXY GALAXY_RED
plate	1678
mjd	53433
fiberid	425

Esercizio 2
… selezioniamo i nuclei galattici attivi!

4

Optical Spectra SpecObjID = 1889376924388583424

Interactive spectrum



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Esercizio 2

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1	2	3	4	5	6	7	8	9	10
# ID	SDSS_NAME	RA	DEC	OIII_5007_FLUX	H_BETA_FLUX	NII_6584_FLUX	H_ALPHA_FLUX	OIII_Hbeta	NII_Halpha
1	SDSS_J033355.94-001530.2	53.4831	-0.25839934	164.1306	30.912266	102.66211	114.50883	5.309562	0.8965432
2	SDSS_J010730.48+141221.7	16.877012	14.206061	107.47293	44.769157	132.5542	172.68938	2.400602	0.7675875
3	SDSS_J151806.13+424445.0	229.525575754	42.745853761	994.0776	1166.7118	4143.2925	8096.605	0.85203356	0.5117321
4	SDSS_J033437.45+002419.3	53.656048	0.4053838	23.09568	30.456774	28.835886	120.51385	0.75831014	0.23927446
5	SDSS_J015616.50+144141.5	29.068716	14.694918	75.98611	151.35889	156.71399	547.63605	0.5020261	0.2861645
6	SDSS_J023014.02-081114.4	37.5584	-8.187359	48.304985	32.188362	115.384865	129.69699	1.5006973	0.8896495
7	SDSS_J000033.77+151102.0	0.14075013	15.183925	83.87299	54.194748	31.803131	175.25182	1.5476222	0.18147105
8	SDSS_J033213.20+001546.7	53.055042	0.2629581	147.30008	52.55818	557.5114	501.89618	2.80261	1.1108103
9	SDSS_J000149.09-101314.5	0.45457342	-10.2207	34.438747	45.75706	44.503025	169.4995	0.75264335	0.2625555
10	SDSS_J015656.63-085350.8	29.235968	-8.897464	155.97792	27.135801	91.734024	124.685	5.7480493	0.73572624
11	SDSS_J004123.78+152110.5	10.349067	15.352971	65.89234	124.57469	136.344	443.261	0.5289384	0.30759305
12	SDSS_J021259.77-093902.0	33.24908	-9.650567	54.171364	130.05997	176.37895	506.08154	0.41651067	0.34851885
13	SDSS_J021112.46-004933.3	32.802532	-0.82586586	8.400914	13.805727	26.803669	56.58422	0.60850936	0.4736951
14	SDSS_J075943.86+422241.0	119.93278	42.37806	70.9665	56.304527	37.925262	209.92525	1.2604048	0.1806608
15	SDSS_J072847.38+382236.6	112.19744	38.37684	40.546753	71.046104	95.244095	346.57098	0.5707104	0.27481842
16	SDSS_J074054.00+342234.4	115.22502	34.37622	1281.958	147.7447	419.52405	596.512	8.676846	0.70329523
17	SDSS_J075736.13+130122.7	119.40057	13.022983	88.41275	58.36004	27.568174	196.66638	1.5149536	0.14017735
18	SDSS_J072227.45+422832.9	110.61438	42.475826	62.794968	33.18421	79.81472	157.8296	1.8923146	0.50570184
19	SDSS_J073011.88+393707.2	112.54955	39.618675	27.446512	63.430706	70.84754	222.61375	0.43270072	0.31825322
20	SDSS_J074259.01+194431.1	115.74589	19.741983	252.15233	35.95666	148.25749	135.91348	7.0126734	1.0908226
21	SDSS_J082925.47+140733.1	127.35618	14.125883	103.66946	87.22019	55.92245	290.89468	1.1885947	0.19224295
22	SDSS_J081532.39+032856.5	123.88497	3.4823573	112.16669	129.81564	110.111786	477.20975	0.864046	0.23074086
23	SDSS_J082900.57+311533.6	127.25234	31.259382	208.61705	35.993736	158.9534	177.24316	5.7959266	0.89680976
24	SDSS_J080214.80+365424.2	120.56169	36.906746	67.50491	92.005226	80.89571	330.42267	0.73370737	0.24482495
25	SDSS_J085828.89+270939.1	134.6204	27.160868	117.18722	33.055393	107.51888	178.91138	3.545177	0.6009617
26	SDSS_J085103.17+513745.6	132.76324	51.629345	125.34069	175.22331	247.12169	832.01434	0.7153197	0.29701614

misure dell'intensità delle righe di emissione di atomi di Idrogeno, Ossigeno e Azoto

Esercizio 2

… selezioniamo i nuclei galattici attivi!

1	2	3	4	5	6	7	8	9	10
# ID	SDSS_NAME	RA	DEC	OIII_5007_FLUX	H_BETA_FLUX	NII_6584_FLUX	H_ALPHA_FLUX	OIII_Hbeta	NII_Halpha
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4	SDSS_J033437.45+002419.3	53.656048	0.4053838	23.09568	30.456774	28.835886	120.51385	0.75831014	0.23927446
5	SDSS_J015616.50+144141.5	29.068716	14.694918	75.98611	151.35889	156.71399	547.63605	0.5020261	0.2861645
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9	SDSS_J000149.09-101314.5	0.45457342	-10.2207	34.438747	45.75706	44.503025	169.4995	0.75264335	0.2625555
10	SDSS_J015656.63-085350.8	29.235968	-8.897464	155.97792	27.135801	91.734024	124.685	5.7480493	0.73572624
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14	SDSS_J075943.86+422241.0	119.93278	42.37806	70.9665	56.304527	37.925262	209.92525	1.2604048	0.1806608
15	SDSS_J072847.38+382236.6	112.19744	38.37684	40.546753	71.046104	95.244095	346.57098	0.5707104	0.27481842
16	SDSS_J074054.00+342234.4	115.22502	34.37622	1281.958	147.7447	419.52405	596.512	8.676846	0.70329523
17	SDSS_J075736.13+130122.7	119.40057	13.022983	88.41275	58.36004	27.568174	196.66638	1.5149536	0.14017735
18	SDSS_J072227.45+422832.9	110.61438	42.475826	62.794968	33.18421	79.81472	157.8296	1.8923146	0.50570184
19	SDSS_J073011.88+393707.2	112.54955	39.618675	27.446512	63.430706	70.84754	222.61375	0.43270072	0.31825322
20	SDSS_J074259.01+194431.1	115.74589	19.741983	252.15233	35.95666	148.25749	135.91348	7.0126734	1.0908226
21	SDSS_J082925.47+140733.1	127.35618	14.125883	103.66946	87.22019	55.92245	290.89468	1.1885947	0.19224295
22	SDSS_J081532.39+032856.5	123.88497	3.4823573	112.16669	129.81564	110.111786	477.20975	0.864046	0.23074086
23	SDSS_J082900.57+311533.6	127.25234	31.259382	208.61705	35.993736	158.9534	177.24316	5.7959266	0.89680976
24	SDSS_J080214.80+365424.2	120.56169	36.906746	67.50491	92.005226	80.89571	330.42267	0.73370737	0.24482495
25	SDSS_J085828.89+270939.1	134.6204	27.160868	117.18722	33.055393	107.51888	178.91138	3.545177	0.6009617
26	SDSS_J085103.17+513745.6	132.76324	51.629345	125.34069	175.22331	247.12169	832.01434	0.7153197	0.29701614

fare il rapporto tra
colonna 5 / colonna 6 = colonna 9
colonna 7 / colonna 8 = colonna 10

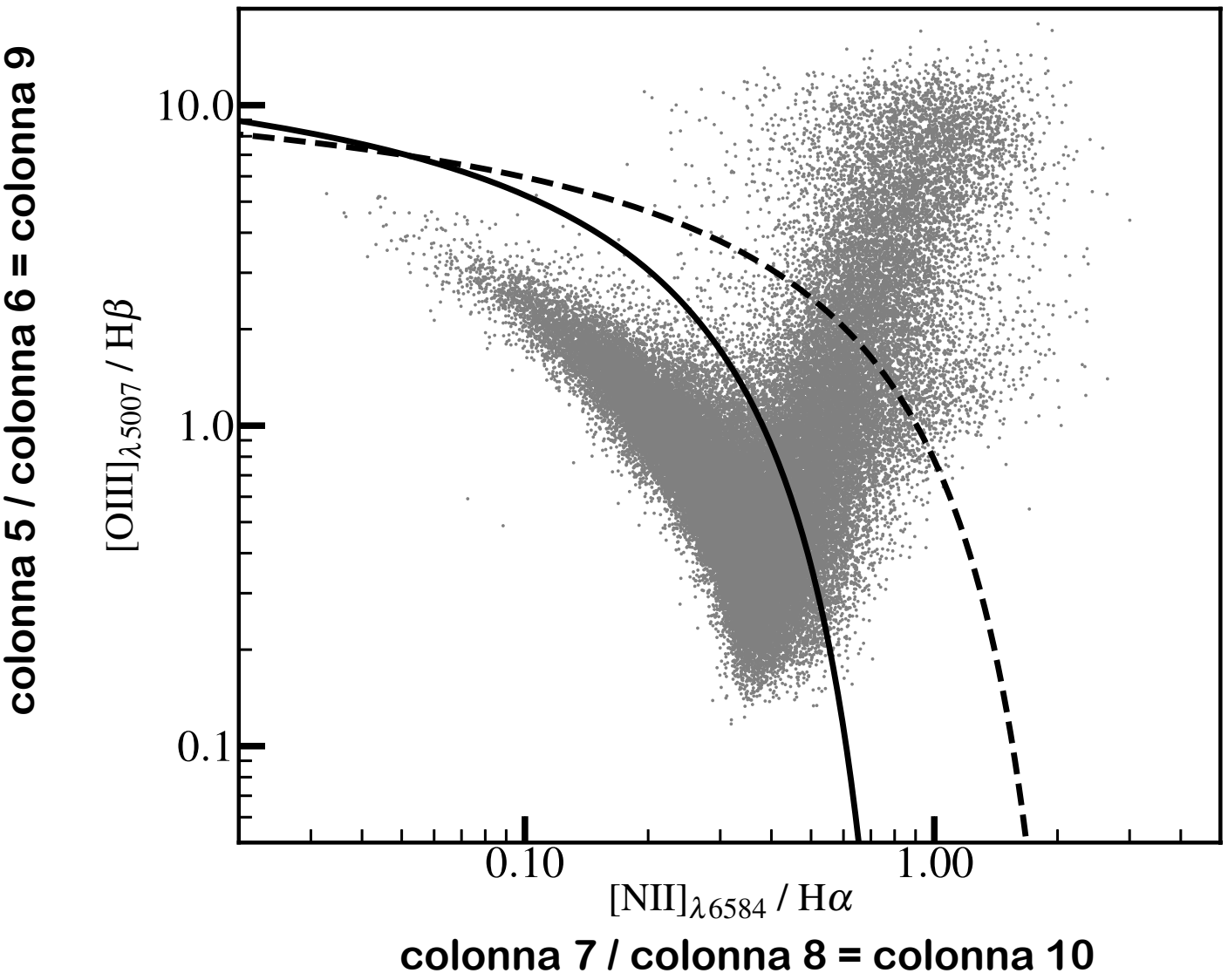

colonna 5 / colonna 6 = colonna 9
10.0
1.0
0.1
[OIII]λ5007 / Hβ
0.10
1.00
[NII]λ6584 / Hα
colonna 7 / colonna 8 = colonna 10

Diagramma diagnostico

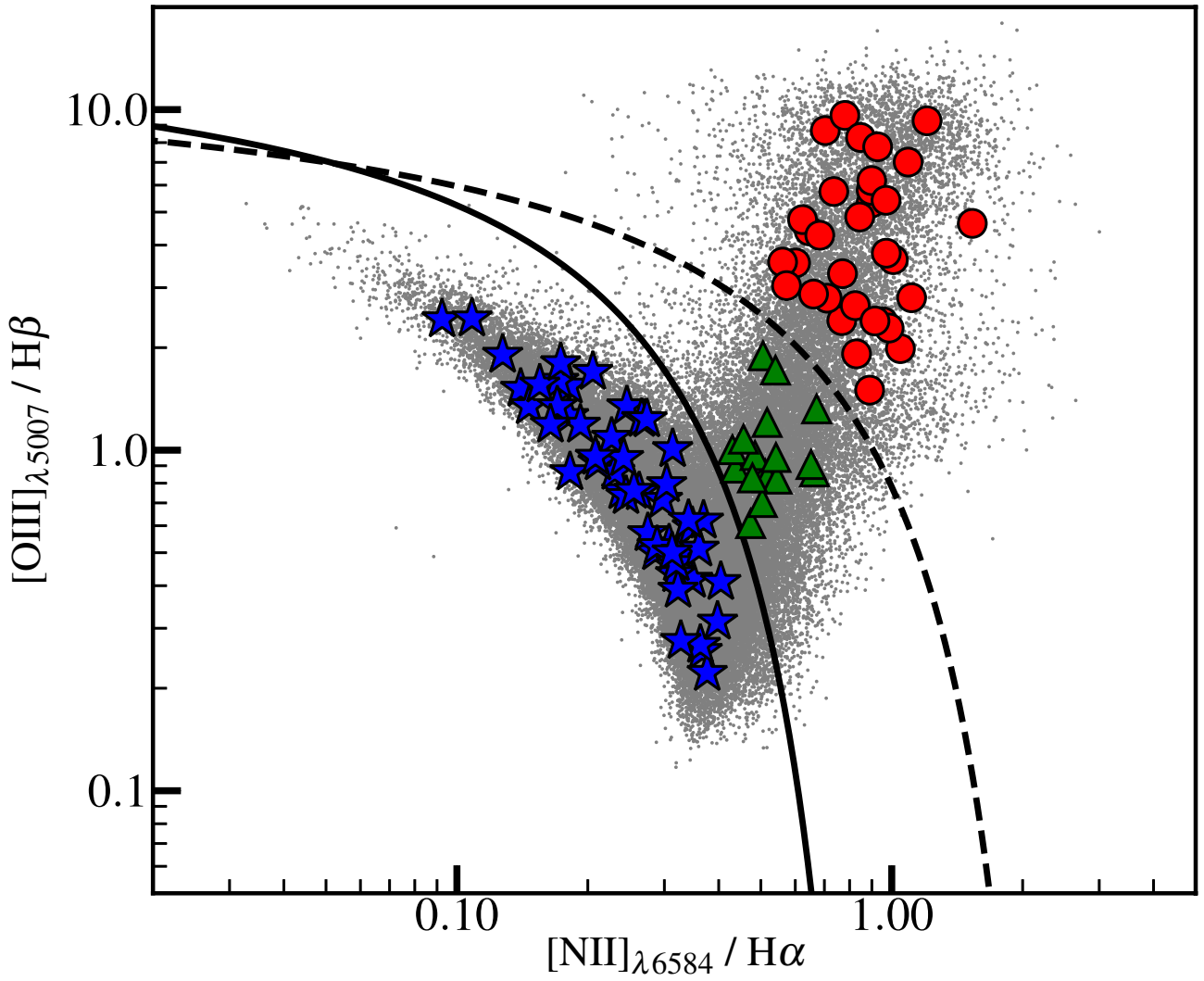
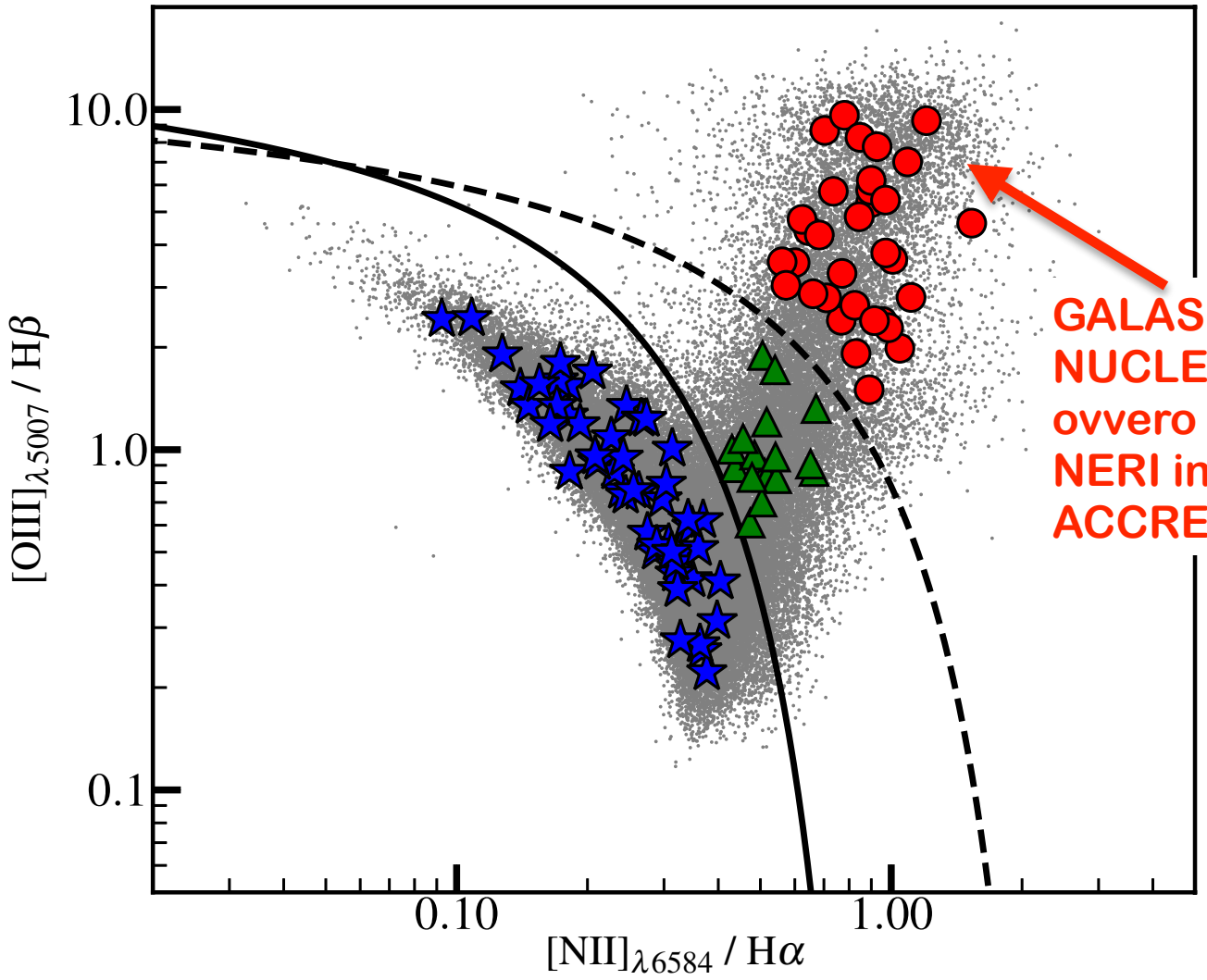


Diagramma diagnostico



GALASSIE con NUCLEI "ATTIVI", ovvero BUCHI NERI in ACCRESCIMENTO

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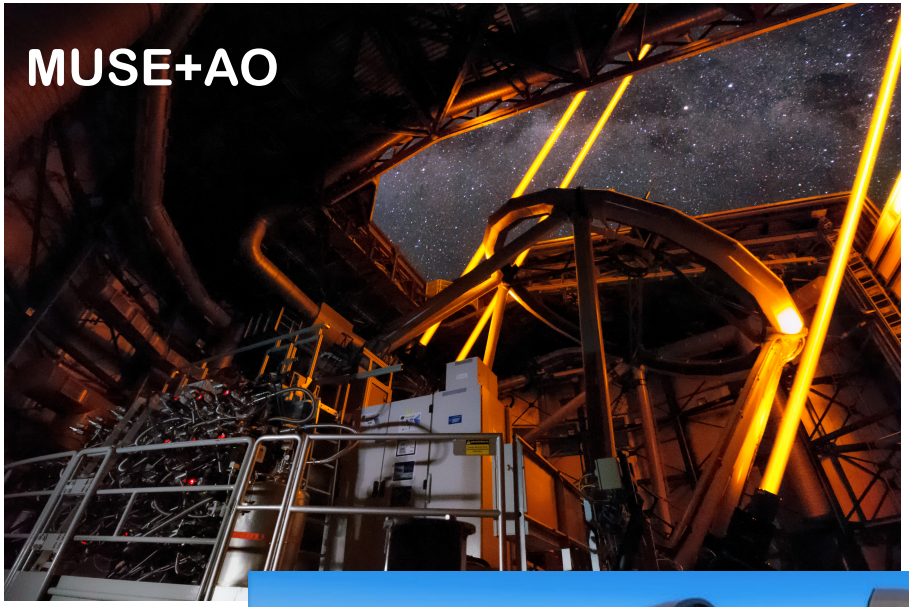

The future is bright!


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Thank you!