



Publication Year	2016
Acceptance in OA	2020-05-06T12:46:23Z
Title	VizieR Online Data Catalog: Evolution of ~6Ms CDF-S galaxies (Lehmer+, 2016)
Authors	Lehmer, B. D., Basu-Zych, A. R., Mineo, S., Brandt, W. N., Eufrasio, R. T., Fragos, T., Hornschemeier, A. E., Luo, B., Xue, Y. Q., Bauer, F. E., Gilfanov, M., Ranalli, P., Schneider, D. P., Shemmer, O., TOZZI, Paolo, Trump, J. R., Vignali, C., Wang, J. -X., Yukita, M., Zezas, A.
Handle	http://hdl.handle.net/20.500.12386/24544
Journal	VizieR Online Data Catalog

J/ApJ/825/7

Evolution of ~6Ms CDF-S galaxies

(Lehmer+, 2016)

The evolution of normal galaxy X-ray emission through cosmic history: constraints from the 6Ms Chandra Deep Field-South.
Lehmer B.D., Basu-Zych A.R., Mineo S., Brandt W.N., Eufrasio R.T., Fragos T., Hornschemeier A.E., Luo B., Xue Y.Q., Bauer F.E., Gilfanov M., Ranalli P., Schneider D.P., Shemmer O., Tozzi P., Trump J.R., Vignali C., Wang J.-X., Yukita M., Zezas A.
<Astrophys. J., 825, 7-7 (2016)>
[=2016ApJ...825....7L](#) (SIMBAD/NED BibCode)

ADC_Keywords: Active gal. nuclei ; X-ray sources ; Surveys ; Redshifts

Keywords: galaxies: evolution; surveys; X-rays: binaries; X-rays: galaxies; X-rays: general

Abstract:
We present measurements of the evolution of normal-galaxy X-ray emission from $z\sim 0-7$ using local galaxies and galaxy samples in the ~6Ms Chandra Deep Field-South (CDF-S) survey. The majority of the CDF-S galaxies are observed at rest-frame energies above 2keV, where the emission is expected to be dominated by X-ray binary (XRB) populations; however, hot gas is expected to provide small contributions to the observed-frame $\lesssim 1$ keV emission at $z\lesssim 1$. We show that a single scaling relation between X-ray luminosity (L_X) and star-formation rate (SFR) literature, is insufficient for characterizing the average X-ray emission at all redshifts. We establish that scaling relations involving not only SFR, but also stellar mass (M_*) and redshift, provide significantly improved characterizations of the average X-ray emission from normal galaxy populations at $z\sim 0-7$. We further provide the first empirical constraints on the redshift evolution of X-ray emission from both low-mass XRB (LMXB) and high-mass XRB (HMXB) populations and their scalings with M_* and SFR, respectively.

Description:
We began with an initial sample of 32508 galaxies in the Great Observatories Origins Deep Survey South (GOODS-S) footprint as presented in Section 2 of Xue et al. (2012, [J/ApJ/758/129](#)). We cut our initial sample to the 24941 objects that were within 7' of the mean ~6Ms CDF-S aimpoint, a region where the Chandra point-spread function (PSF) is sharpest and the corresponding X-ray sensitivity is highest. See text for further explanations.

File Summary:

FileName	Lrec1	Records	Explanations
ReadMe	80	.	This file
table1.dat	75	63	Stacked subsample properties
table2.dat	124	63	Galaxy stacking results

See also:
[J/ApJ/813/82](#) : $z<0.06$ broad-line AGN emission-line measures (Reines+, 2015)
[J/ApJ/801/97](#) : GOODS-S+UDS stellar masses from CANDELS (Santini+, 2015)
[J/MNRAS/446/470](#) : ULX candidates in luminous IR galaxies (Luangtip+, 2015)
[J/ApJ/777/18](#) : Stellar mass functions of galaxies to $z=4$ (Muzzini+, 2013)
[J/ApJ/776/L31](#) : Energy feedback from XRB from $z=0$ to $z=19.92$ (Fragos+, 2013)
[J/ApJ/774/136](#) : Xray obs. of SINGS gal. compared to models (Tzanavaris+, 2013)
[J/ApJ/766/19](#) : XRB population synthesis models in $0<z<20$ gal (Tremmel+, 2013)
[J/ApJ/764/41](#) : X-ray binary evolution across cosmic time (Fragos+, 2013)
[J/ApJ/758/129](#) : 4Ms Chandra Deep Field South 6-8keV galaxies (Xue+, 2012)
[J/A+A/542/A16](#) : X-ray detection of radio-selected SF galaxies (Ranalli+, 2012)
[J/MNRAS/420/2190](#) : ECDFS sources with radio counterparts (Vattakunnel+, 2012)
[J/MNRAS/419/2095](#) : HMXBs in nearby galaxies (Mineo+, 2012)
[J/ApJ/742/3](#) : Photometric catalogs for ECDF-S and CDF-N (Rafferty+, 2011)
[J/ApJ/740/37](#) : Obscured AGN at $z\sim 0.5-1$ in the CDFS (Luo+, 2011)
[J/A+A/533/A119](#) : GOODS-Herschel North and South catalogs (Elbaz+, 2011)
[J/ApJS/195/10](#) : The CDF-S survey: 4Ms source catalogs (Xue+, 2011)
[J/ApJS/191/124](#) : Optical spectrosc. of ECDF-S X-ray sources (Silverman+, 2010)
[J/ApJ/681/1163](#) : Late-type galaxies in Chandra deep fields (Lehmer+, 2008)
[J/A+A/437/883](#) : K20 survey: spectroscopic catalogue (Mignoli+, 2005)
[J/ApJS/155/271](#) : CDF-South: Optical spectroscopy (Szokoly+, 2004)
[J/ApJ/602/231](#) : Chandra X-ray point sources in nearby gal. (Colbert+, 2004)
<http://hedam.lam.fr/GOODS-Herschel/> : GOODS-Herschel survey home page

Byte-by-byte Description of file: [table1.dat](#)

Bytes	Format	Units	Label	Explanations
1- 3	I3	---	Seq	Unique stacked subsample identifier (1).

5- 7	F3.1	---	zlo	[0/5] Lower redshift boundary of sample
9- 11	F3.1	---	zup	[0.5/7] Upper redshift boundary of sample
13- 16	F4.2	---	<z>	[0.3/6] Mean redshift
18- 19	I2	---	NGal	[12/60] Number of galaxies stacked in bin
21	I1	---	Ndet	[0/7] Number of sources detected individually in bin
23- 26	F4.1	Msun/yr	SFRlo	[0.2/27.3] Lower SFR boundary of sample
28- 32	F5.1	Msun/yr	SFRup	[21.7/707] Upper SFR boundary of sample
34- 38	F5.1	Msun/yr	<SFR>	[0.8/132] Mean Star Formation Rate
40- 43	F4.1	Msun/yr	e_<SFR>	[0.4/52] The 1 σ error in <SFR>
45- 48	F4.1	[Msun]	logM*	[9.3/11] Log mean stellar mass (2)
50- 52	F3.1	[Msun]	e_logM*	[0/0.1] The 1 σ error in logM*
54- 58	F5.2	Gyr-1	sSFRlo	[0.01/23] Lower sSFR boundary of sample
60- 64	F5.2	Gyr-1	sSFRup	[0.02/40] Upper sSFR boundary of sample
66- 70	F5.2	Gyr-1	<sSFR>	[0.02/28] Mean specific Star Formation Rate
72- 75	F4.2	Gyr-1	e_<sSFR>	[0.01/9] The 1 σ error in <sSFR>

Note (1): The subsample ID has been assigned to each subsample and is ordered based on ascending redshift bin, and within each redshift bin, ascending sSFR.

Note (2): The stellar mass is bounded by limits on SFR and sSFR, as well as a hard lower bound of $M^{\text{lim}}_* = 1e9 \text{ solMass}$.

Byte-by-byte Description of file: [table2.dat](#)

Bytes	Format	Units	Label	Explanations
1- 2	I2	---	Seq	Unique stacked subsample identifier
4- 7	F4.1	---	S/N0.5-1	[-0.7/14.1] Signal-to-Noise in 0.5-1keV band
9- 12	F4.1	---	S/N1-2	[-0.1/18] Signal-to-Noise in 1-2keV band
14- 17	F4.1	---	S/N2-4	[-2/9.1] Signal-to-Noise in 2-4keV band
19	A1	---	l_C0.5-1	Limit flag on C0.5-1
20- 24	F5.1	ct	C0.5-1	[21/266] Net 0.5-1 keV counts (3)
26- 30	F5.1	ct	e_C0.5-1	[8/180]? The 1 σ error in C0.5-1
32	A1	---	l_C1-2	Limit flag on C1-2
33- 37	F5.1	ct	C1-2	[32/438] Net 1-2 keV counts (3)
39- 43	F5.1	ct	e_C1-2	[8/297]? The 1 σ error in C1-2
45	A1	---	l_C2-4	Limit flag on C2-4
46- 50	F5.1	ct	C2-4	[32/200] Net 2-4 keV counts (3)
52- 56	F5.1	ct	e_C2-4	[18/160]? The 1 σ error in C2-4
58	A1	---	l_BR1	Limit flag on BR1
59- 62	F4.1	---	BR1	[1/4] The (1-2keV)/(0.5-1keV) band ratio
64- 66	F3.1	---	e_BR1	[1/8]? The 1 σ error in BR1
68	A1	---	l_BR2	Limit flag on BR2
69- 72	F4.1	---	BR2	[0.4/2] The (2-4keV)/(1-2keV) band ratio
74- 76	F3.1	---	e_BR2	[0.7/4]? The 1 σ error in BR2
78	A1	---	l_logL1	Limit flag on logL1
79- 83	F5.1	[10-7W]	logL1	[39.9/43] Log 0.5-2keV luminosity; erg/s
85- 87	F3.1	[10-7W]	e_logL1	[0.1/0.2]? 1 σ error in logL1
89	A1	---	l_logL2	Limit flag on logL2
90- 94	F5.1	[10-7W]	logL2	[39.8/43] Log 2-10keV luminosity; erg/s
96- 98	F3.1	[10-7W]	e_logL2	[0.1/0.3]? 1 σ error in logL2
100	A1	---	l_logL/SFR	Limit flag on logL/SFR
101-105	F5.1	[10-7W/Msun.yr]	logL/SFR	[39.4/41] Log 2-10keV luminosity per mean SFR ratio
107-109	F3.1	[10-7W/Msun.yr]	e_logL/SFR	[0.1/0.3]? 1 σ error in logL/SFR
111-114	F4.2	%	fAGN	[0/9] Estimated fraction of 2-10keV emission from undetected AGN (4)
116-119	F4.2	%	E_fAGN	[0/7] Upper 1 σ error in fAGN
121-124	F4.2	%	e_fAGN	[0/4] Lower 1 σ error in fAGN

Note (3): Background-subtracted.

Note (4): These estimates are computed following the methodology outlined in Section 6.1.

History:

From electronic version of the journal

(End) Prepared by [AAS], Emmanuelle Perret [CDS] 19-Aug-2016

The document above follows the rules of the [Standard Description for Astronomical Catalogues](#); from this documentation it is possible to generate *f77* program to load files [into arrays](#) or [line by line](#)

