

ESA's Science Operations Centre – ESAC



Then: VilSpa

ESA **VIL**lafranca **SPA**in Satellite Tracking Station.







esa

Key dates for VilSpa/ESAC

- > 1978: Opening of **VILSPA.**
- > 1970s, 80s and 90s: Support for astronomy missions:
 - > IUE, ISO, XMM-Newton.
- Early 2000s: Expansion to planetary missions:
 - > Rosetta, MEX, VEX.
- > 2005: Cebreros DSA inaugurated.
- > 2008: VILSPA became ESAC the European Space Astronomy Centre.



ESA UNCLASSIFIED - For Official Use

Kessler | ESA's Science Operations Centre - ESAC | 25 May 2018 | Slide 4

European Space Agency

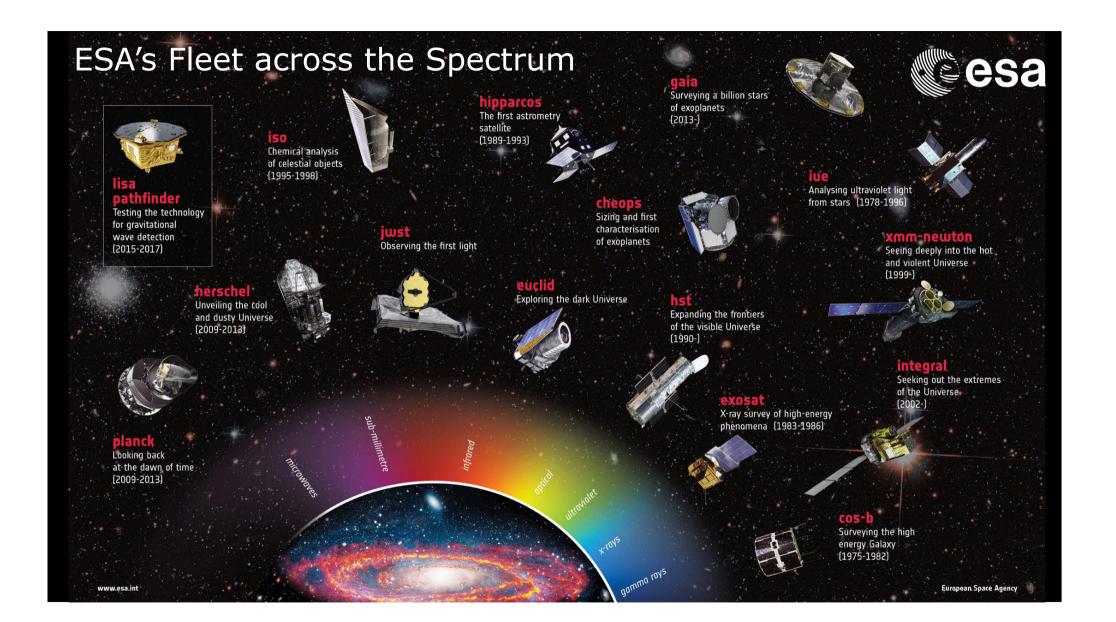
ESAC Main Activities Now

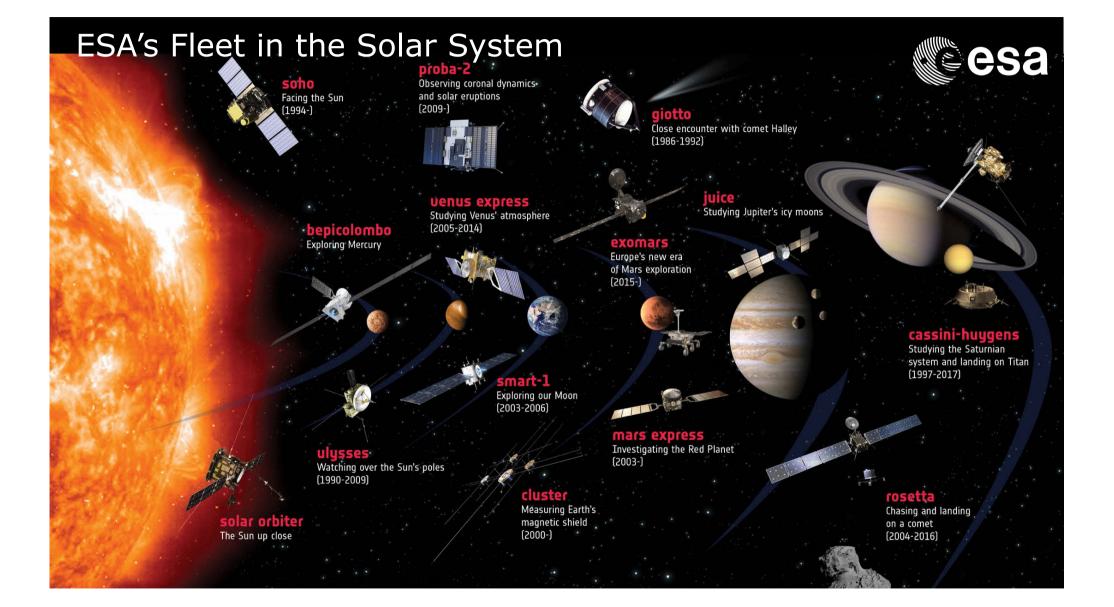
- \succ Satellite tracking,
- > Farth Observation:
 - SMOS Spanish National Centre,
- > INTA/CSIC Astrobiology Centre (CAB),
- Galileo Navigation Science Office,
- Contribution to Space Situational Awareness,
- \succ ESAC Education activities,
- ESAC Communication activities,
- > ESA's Science Programme:
 - Science ops including archives, in-orbit management.











D/SCI Operations Department

- Overall management of ESA's operational space science missions.
- Science Operations Centres (SOCs) for
 - Astronomy,
 - Heliospheric, and
 - Planetary missions.
- Science Data Archives
 - Iong-term access to data & information.
- Involved in ~25 missions/studies.
- Over 200 scientists and engineers involved at ESAC and at STScI, GSFC, ESTEC, ...

ESA UNCLASSIFIED - For Official Use





Kessler | ESA's Science Operations Centre - ESAC | 25 May 2018 | Slide 8

European Space Agency

Science Operations Centres

Provide, usually with member state/international partners, some/all of following elements:

- Interfaces to users,
- Payload operations,
- Payload data acquisition and processing,
- Science data archiving and distribution,
- Plus associated software (and procedures).



Kessler | ESA's Science Opera



EXOSAT Reunion 2018





ESA UNCLASSIFIED - For Official Use

Kessler | ESA's Science Operations Centre - ESAC | 25 May 2018 | Slide 10

European Space Agency 🔤 🔤 🔤 📰 📲 🔤 🔤 📲 🛶 🚳 📲 🚍 👫 🚔 🙀

Science Operations Centres

Provide, usually with member state/international partners, some/all of following elements:

- Interfaces to users,
 - > calls for proposals, information, workshops, training, helpdesk, ...
- Payload operations,
 - scientific scheduling and optimisation, payload monitoring, quicklook data analysis, ...
- Payload data acquisition and processing,
 - calibration and cross-calibration, interactive and pipeline processing tools, ...
- Science data archiving and distribution,
 - archive development, population and maintenance, ...
- Plus associated software (and procedures).
 - development, integration, test, operation and maintenance.

ESA UNCLASSIFIED - For Official Use

Kessler | ESA's Science Operat

Operations: ESOC and ESAC Tasks

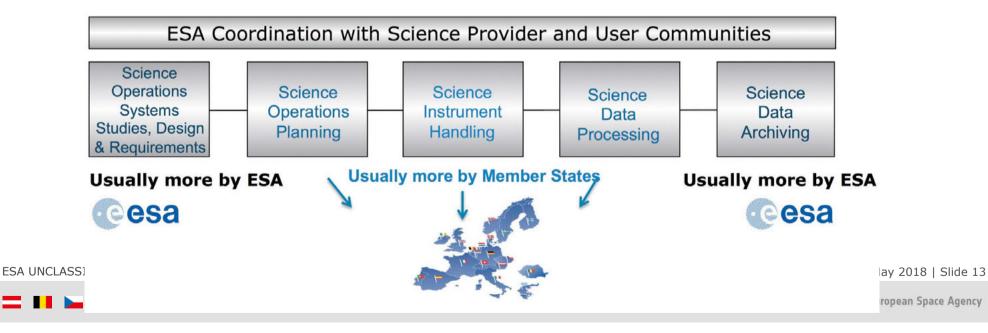






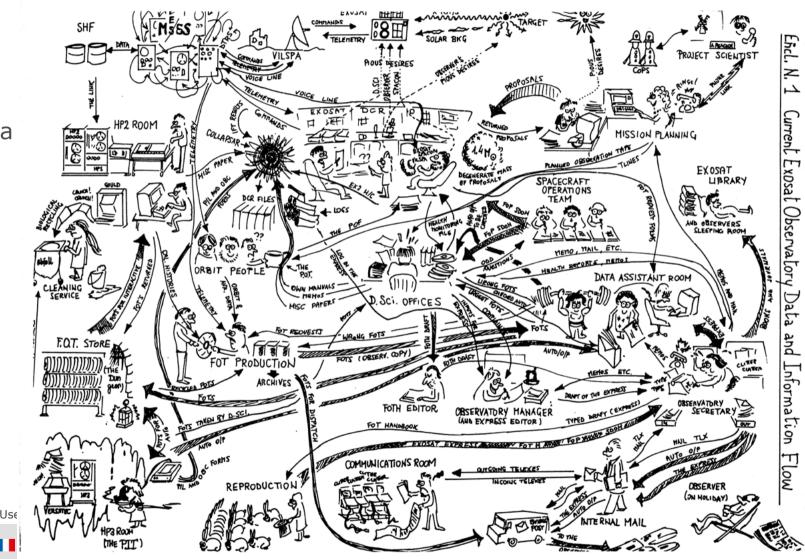
Collaborations with Member States

- Science ground segments now collaborative developments with multiple Member State entities.
- Member States usually contribute bulk of resources.
- ESA provides overall coordination
- > ESA has overall responsibility for mission.



Then:

EXOSAT Observatory Data and Information Flow

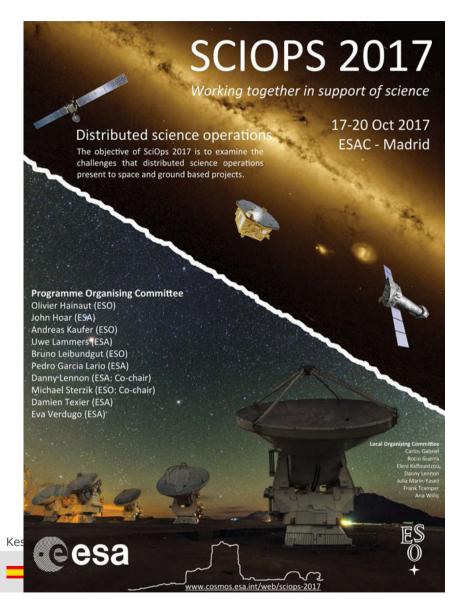


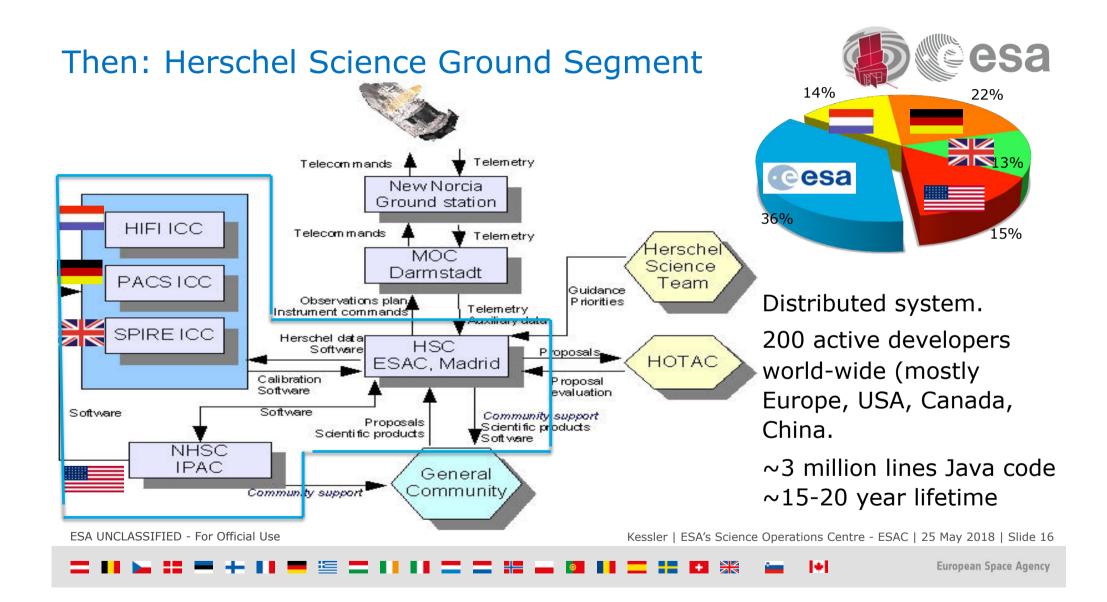
Now → Distributed (Sci-)Ops

> 2017 Collaborative workshop with ESO

> Aims:

- Focus on challenges that distributed science operations present to space and ground based projects,
- Promote the interchange of ideas and information between ESA, ESO and the broader community.



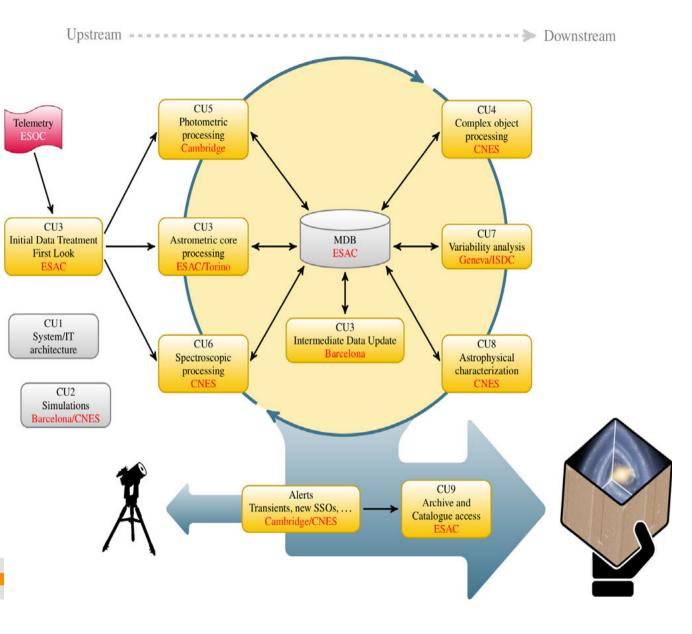


Now: Gaia-DPAC

DPAC = Data Processing Analysis Consortium

- 9 Coordination Units (CUs)
- 6 Data Processing Centres
- 450+ scientists + engineers
- > ~20 countries

ESA UNCLASSIFIED - For Official Use



Science Data Archives

4000	
and party	- and the second sector are
hers/sec	Contraction and and and an and and and and and and
Read Trap	Better and the sentences
-	1 Los (1) Contraction of the state
1.044	E contraction of the
by the	A CARDON MANAGER
-	State Street and
-	S. The Constant State of the
	a constant of the second se

Enable maximum *scientific exploitation* of data sets

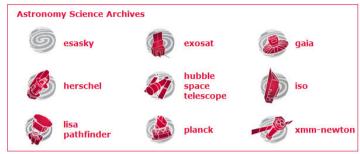


Enable efficient *long-term preservation* of data, software and knowledge, using modern technology

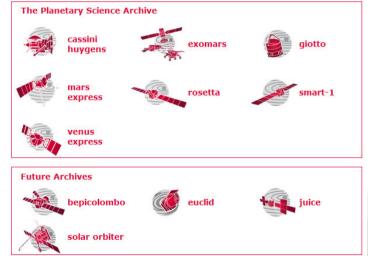


Enable cost-effective archive production by *integration in, and across, projects*

ESAC SCIENCE DATA CENTRE







Archives \rightarrow inc science-ready products

a archive	e													and the	eesa
SEARCH STATISTIC	ts vesual	IZATION HE	LP DOCUMENT	ATION							A MILE	and the second	Contraction of	12000	- Stores
om ADQLForm Q	1000														
. * .	* .	a name.													Query examples
-	- A [SELECT DES	TANCE (POINT ("	ICRS', zs, dec), PC 'ICRS', zs, dec), C3	DINT (*1CRS*, 24	66.41603	,-29.0078	11)) 35 dist, *							
galadit.allwise_test_re		NUESE 1=CC	NTALNI (POINT)	"ICH3", za, dec), C1	DICLE (*1083*, 2	266.4165	3,-29.001	781, 0.05333333)	ORCER BY dist	190					
galodit.allwise_reighte galodit.allwise_reighte															
galadi1.aut_qso_jot2_)	mat												beset Form	🔍 Saturit Que	
galadi 1. cepheid													osat Form	A stamit dat	~
galadit.ad_phot_tero_p															
paindr1.pec23_best_ne				Job					Creation date		Rars, rows	Size			
galadin gec23_neighbo			1 8	1491236340474	0				G-Apt-2017, 18:19:00		1316	254 KB		DEBAOME	
galadi1.psc23_otipical, galadi1.ptct_variable_ti	me .														
galadit.phot_variable_ti	ime_														1
galad1.ppmd_best_net galad1.ppmd_best_net		D			80			Con.							
galad1.ppmd_neighol galad1.ppmd_original_			1245					340				1			
galad1.stype				7 /											
galadr1.sdss_dr9_best, galadr1.sdss_dr9_best,				and the second							OK NIBIJAN	Bet, and Sola	pu T	ex, paska, cor himpon	
galadit.sdssdtl_origin		1000	1	Constant of the	A	-	-	1	5						
galadr1.tgas_source			1 +		-		1	1							
galad1.trass_test_re galad1.trass_reigtoo														(a	
galadr1.brass_original,	yall			- Contractor		-0		1.00							
galad1.scao4_best_rel			1944		1.00	حك								Handlindill	
galadr1.ucac4_neigtbo											passia, ensitietogram	paratic, protec	unnigan	pasta, program tempera	
galadit.ural1_best_neig	phoc		Danage -	ag for pained i gang, source (surface of	Concern per square impres	Realize Laured	unia 110, 1 milijo	-							
galadit.uratt_neightou galadit.uratt_orginal_s	rhoc														
Stand Lotter Condition															
		Y	5						2		Download format	onabe 💽 🛛		n og fundstan (palt active) al för	
XMM-Newto Holiz State	n Scien	ce Archiv	/c	CATALOOLES & 1001.5	DOCUMENTATION	сонты			Q.,	1	Download format	Jiase S			And the second
XMM-Newto	n Scien	ce Archiv	/c	CARLOQUES & VIDULS	DOCUMENTATION	сонтис	7		2	4	Download format (15 ISSENTE (412)
XMM-Newto IIOM EARC Cacto Sare		ce Archit	Add to Beniet	Leve bills as	fared lable to		3								15 ISSENTE (412)
XMM-Newto ION LAR Cacta San Co T Rest 7 C Gitt Ballon C Cours	n Scien	ce Archiv	/C TaP QUENE'S Addies Stankel Target			Rev	CF Distance	Start Date	Ind Gate	Dec	Download format (1)				15 ISSENTE (412)
XMM-Newto NON Educi Data San Co T Reads 7 T OSSERTION Common	n Scien Comans es ero x comans es ero x comans es ero x	ce Archit	Artra Basket Darp Darb Darb	bil form table on RA 091-341132-005	Invest bible to BEC +238 80' 52,0''		8.01	2013-02-23 00 19 37	2013-42-23 42 18 36	7558	Tentiet (Sper- sper Chub-Loo				15 ISSENTE (412)
XMM-Newto NOR 2000 T Reals 2 T General Commission Commi	n Scien communication s (10) X communication s (10) X communication comm	ce Archit	Artis Baski Tarpet Die Die	Build Read 000:3400-32:005 006:3400-32:005			8.01 8.01	2815-32-23 80 1937 2815-32-23 17 58-26	2015-40-25 42-19-36 2015-40-25 22-19-36	7138 20948	Target Type your CARALINE South CARALINE				15 ISSENTE (412)
XMM-Newton Role Luco To Rest 92 To Rest 92 T	n Scien Comans es ero x comans es ero x comans es ero x	cc Archite seu Access seu Recess seu Recess	Addres Basket Dar October Addres Basket Cano Cano Cano	bil form table on RA 091-341132-005	Bend basis to BEC -228 80' 52.0" -228 80' 52.0" -228 80' 52.0"	8897 2019 2019 2019	8.01	2013-02-23 00 19 37	2013-42-23 42 18 36	7558	Tentiet (Sper- sper Chub-Loo				15 ISSENTE (412)
XMM-Newto sour success treestar t	n Scien coman coman se so x coman se so x coman se so x coman se so x coman se so x	cc Archite seus Access seus Recess of a of a	Addres Rester Day Openaes Addres Rester Day Day Day Day Day Day Day	Barrie tatilite en SA Olin Jain 32 Olis Olin Jain 32 Olis Olin Jain 32 Olis Olin Jain 32 Olis Olin Jain 31 Olis Olin Jain 31 Olis	BEC -228 80 52 0° -228 80 52 0° -228 80 52 0° -228 80 52 0°	8899 2019 2019 2019 2019 2019	0.01 0.01 0.01 0.01	2015-02-23 50 19:37 2015-02-23 17 50:26 2015-08-02 19:29:36 2015-08-02 19:20:36	2015-42-23 42 19 39 2015-42-23 22 39 29 2015-49-42 47 45 19 2015-49-42 47 45 19	7158 20646 11589 17779	Terget Type 900 CALLUR 500 CALLUR 500 CALLUR 500 CALLUR		CEPHOLOT DO DATABASE		15 ISSENTE (412)
XMMA-Newton som stars to som st	CORRANG C	co Archiv seu Accss seu Accss seu Accss seu seu seu seu seu seu seu seu seu s	Attractions Date Standard Case Case Case Case Case Case Case Case	None Solution Solution <th< td=""><td>Beec -208 80 52 0° -208 80 52 0° -208 80 52 0° -208 80 52 0° -208 80 52 0° -208 80 52 0° -208 80 52 0°</td><td>8897 2419 2119 2119 2119 2119 2119</td><td>8.01 8.01 8.01 8.01 8.01</td><td>2015-02-20 00 19:07 2015-02-20 17 58:26 2015-09-62 04 29:99 2016-09-60 19:58:16 2016-03-66 17:05:08</td><td>2013-42-23 42 18-35 2013-42-23 22 39-36 2013-64-22 17-43 19 2013-66-88 19-36-89 2014-63-64 2018 10</td><td>7158 20546 11589 17779 8000</td><td>Тарит Тари 944 Сладов 944 Сладов 944 Сладов 944 Сладов 944 Сладов 944 Сладов 944 Сладов 944 Сладов</td><td></td><td>CEPHOLAT 20</td><td></td><td>15 ISSENTE (412)</td></th<>	Beec -208 80 52 0° -208 80 52 0° -208 80 52 0° -208 80 52 0° -208 80 52 0° -208 80 52 0° -208 80 52 0°	8897 2419 2119 2119 2119 2119 2119	8.01 8.01 8.01 8.01 8.01	2015-02-20 00 19:07 2015-02-20 17 58:26 2015-09-62 04 29:99 2016-09-60 19:58:16 2016-03-66 17:05:08	2013-42-23 42 18-35 2013-42-23 22 39-36 2013-64-22 17-43 19 2013-66-88 19-36-89 2014-63-64 2018 10	7158 20546 11589 17779 8000	Тарит Тари 944 Сладов 944 Сладов 944 Сладов 944 Сладов 944 Сладов 944 Сладов 944 Сладов 944 Сладов		CEPHOLAT 20		15 ISSENTE (412)
	CORRAN CORRAN CORRAN CORRAN So (95) X CORRAN CORRAN So (95) X CORRAN CORRAN So (95) X CORRAN So (95) X CORRAN CORRAN So (95) X CORRAN CORRAN So (95) X CORRAN So (95) X CORRAN CORRAN CORRAN So (95) X CORRAN CORRAN So (95) X CORRAN COR	Co Archity 56.0 4.40255 60.0 4.00255 60.0 4.00255 60.0 4.00255 60.0 4.00255 60.0 4.00255 60.0 4.00255 60.0 4.00255 60.0 4.00255 60.0 4.00255 60.0 4.00255 60.0 4.00255 60.0 4.00255 60.0 4.00255	After Banks After Banks Tarpet Oak Oak Oak Oak Oak Oak	Base Salitie as 600 560 600 360 360 600 360 360 600 360 360 600 360 360 600 360 360 600 360 360 600 360 360 600 360 370	Construction	8ev 2019 2019 2019 2019 2019 2019 2019 2017	8.01 8.01 8.01 8.01 8.01 8.01	2015-02-20-00 19-37 2015-02-20-17 58-26 2015-09-02-14 29-98 2015-09-02-14 29-98 2016-03-06-17 55-56 2016-03-06-17 55-56 2016-03-06-16 28-19	2013-62-23 62 16-35 2013-62-23 22:39:36 2013-69-62 67 43 19 2013-69-62 67 43 19 2014-63-69 2018:16 2014-63-69 22:25 39	7138 20946 11589 17779 8000 21806	Impert Tage um ctod up u		Cervastart 200 Dectarts 10 Dectarts 10 Dec		15 ISSENTE (412)
	COMMAN COMMAN COMMAN COMMAN COMMAN So (SO) X SO (SO) X SO (SO)	Co Archity 04.0 4.40055 04.0 4.00055 04.0 4.0005 05.0 4.0005 05.0 4.0005 05.0 4.0005 05.0 4.0005 05.0 4.0005 05.0 4.0005 05.0 4.0005 05.0 4.0005 05.0 <td>Arrow Research Darrow Research Crase Crase Crase Crase Crase Crase Crase Crase</td> <td>Iggit Rame balling on SRA Olini Jain 32 Olini Olini Jain 32 Olini Olini Jain 32 Olini</td> <td>Bec Bec -226 40° 10.0° -226 40° 10.0° -226 40° 10.0° -226 40° 10.0° -226 40° 10.0° -226 40° 10.0° -226 40° 10.0° -226 40° 10.0°</td> <td>8899 2419 2419 2419 2419 2419 2419 2419 24</td> <td>8.01 8.01 8.01 8.01 8.01 8.01 8.01</td> <td>2015-02-20-00 19-37 2015-02-20-17-58-36 2015-09-02-34-28-96 2015-09-02-34-28-96 2016-09-06-85-58-98 2016-03-06-17-58-56 2016-03-06-10-28-19 2016-16-00-32-28-36</td> <td>2013-42-23 42 14:34 2013-42:23 22:39-26 2013-45:42 47:43:19 2014-45:44 20:39:19 2014-45:48 20:39:19 2014-45:48 22:23:39 2014-45:48 22:25:39</td> <td>7138 20945 11559 117779 8000 21600 20306</td> <td></td> <td></td> <td>Cervision 200 Cessilos 10 Cessilos 10 Cess</td> <td></td> <td>15 ISSENTE (412)</td>	Arrow Research Darrow Research Crase Crase Crase Crase Crase Crase Crase Crase	Iggit Rame balling on SRA Olini Jain 32 Olini Olini Jain 32 Olini Olini Jain 32 Olini	Bec Bec -226 40° 10.0° -226 40° 10.0° -226 40° 10.0° -226 40° 10.0° -226 40° 10.0° -226 40° 10.0° -226 40° 10.0° -226 40° 10.0°	8899 2419 2419 2419 2419 2419 2419 2419 24	8.01 8.01 8.01 8.01 8.01 8.01 8.01	2015-02-20-00 19-37 2015-02-20-17-58-36 2015-09-02-34-28-96 2015-09-02-34-28-96 2016-09-06-85-58-98 2016-03-06-17-58-56 2016-03-06-10-28-19 2016-16-00-32-28-36	2013-42-23 42 14:34 2013-42:23 22:39-26 2013-45:42 47:43:19 2014-45:44 20:39:19 2014-45:48 20:39:19 2014-45:48 22:23:39 2014-45:48 22:25:39	7138 20945 11559 117779 8000 21600 20306			Cervision 200 Cessilos 10 Cessilos 10 Cess		15 ISSENTE (412)
	CORRAN CORRAN CORRAN CORRAN So (95) X CORRAN CORRAN So (95) X CORRAN CORRAN So (95) X CORRAN So (95) X CORRAN CORRAN So (95) X CORRAN CORRAN So (95) X CORRAN So (95) X CORRAN CORRAN CORRAN So (95) X CORRAN CORRAN So (95) X CORRAN COR	co Archive c	After Banks After Banks Tarpet Oak Oak Oak Oak Oak Oak	Barry balling as 86A 660-1649-22 056 660-1649-22 056 660-1649-22 056 660-1649-22 056 660-1649-21 056 660-1649-21 056 660-1649-21 056 660-1649-21 056 660-1649-21 056 660-1649-21 056 660-1649-21 056 660-1649-21 056 660-1649-21 056	Board Solids 06C -228 67 52.07 -228 67 52.07 -228 67 52.07 -228 67 52.07 -228 67 52.07 -228 67 52.07 -228 67 52.07 -228 67 52.07 -228 67 52.07 -228 67 52.07	8899 28139 28139 28139 28139 2813 2815 2815 2817 2815 2817 2815	8.01 8.01 8.01 8.01 8.01 8.01	2015-02-23-00-19-37 2015-02-23-17-58-26 2015-09-62-34-29-39 2016-03-66-35-58-58 2016-03-66-17-55-59 2016-03-66-03-22-20-06 2016-16-62-33-52-54	2014-43-23 42 1938 2015-45-23 22 3949 2015-45-23 22 3949 2016-45-48 21 07 39 2014-45-48 22 23 39 2014-45-48 22 23 39 2014-45-48 22 23 39	7138 20946 11589 17779 8000 21806	Taget Tage pict CALL	p p p p p p p p p p p p p p	CEPHOSOT 200 Desails 10 Desails 10 Desails 200 Desails		© 053 Srgs 6
		CC Archite Set 0 Access Percent Perc	Artin Sashai Bartin Sashai Case Case Case Case Case Case Case Case	Iggit Rame balling on SRA Olini Jain 32 Olini Olini Jain 32 Olini Olini Jain 32 Olini	Bec Bec -250 40° 16.0° -250 40° 16.0° -250 40° 16.0° -250 40° 16.0° -250 40° 16.0° -250 40° 16.0° -250 40° 16.0° -250 40° 16.0°	8899 2419 2419 2419 2419 2419 2419 2419 24	801 801 801 801 801 801 801 801 801	2015-02-20-00 19-37 2015-02-20-17-58-36 2015-09-02-34-28-96 2015-09-02-34-28-96 2016-09-06-85-58-98 2016-03-06-17-58-56 2016-03-06-10-28-19 2016-16-00-32-28-36	2013-42-23 42 14:34 2013-42:23 22:39-26 2013-45:42 47:43:19 2014-45:44 20:39:19 2014-45:48 20:39:19 2014-45:48 22:23:39 2014-45:48 22:25:39	7138 20640 11599 17779 8000 21800 20300 25900		p p p p p p p p p p p p p p	CEPHOSOT 200 Desails 10 Desails 10 Desails 200 Desails		© 053 Srgs 6
XMM-Newto scale		CC Archives (C)	Attractors Attrac	Normalization Normalization 8A 680-384 32 696 680-384 32 696 680-384 32 696 680-384 32 696 680-384 32 696 680-384 32 696 680-384 32 696 680-384 32 696 680-384 32 696 680-384 32 696 680-384 32 696 680-384 32 696 680-384 32 696 680-384 32 696 680-384 32 696	Bend table to BEC -228 MV 53.07	849 2419 2419 2419 2519 2519 2519 2519 2519 2519 2710 2710 2710 2710	8.01 8.01 8.01 8.01 8.01 8.01 8.01 8.01	2013-22.23 00 1923 2013-22.23 00 1923 2015-09.42 34:25 95 2015-09.42 34:25 95 2014-05.46 1925-06 2014-05.46 1921-06 2014-05.46 1921-06 2014-05.46 1922-06 2014-05.46 1922-06 2014-05.46 1922-04 2015-05.46 1925-14	2014-02-2014 02-2014 2014-02-2012 02-2014 2014-02-2012 02-2014 2014-02-2012 02-2014 2014-02-2014 02-2014 2014-02-2014 2014 2014-02-2014 2014-02-2014 2014 2014 2014 2014 2014 2014 2014	7538 20445 11559 117779 6000 21600 20336 25500 6000 95500		p p p p p p p p p p p p p p	CEPHOSOT 200 Cestain 1 Cestain 1 Cestain 2 Cestain		C 058 3 Spr =
		CC Archives 200 Access	Arro Balar Baro Balar Data Data Data Data Data Data Data Da	Bane table as 60. 60. 60.365.2016 60.565.2016 60.565.2016 60.565.2016 60.565.2016 60.565.2016 60.565.2016 60.565.2016 60.565.2016 60.565.2016 60.565.2016 60.565.2016 60.565.2016 60.565.2016 60.565.2016 60.565.2016 60.565.2016 60.565.2016	Benefit blades tot 066C -2288 60 15.00° -2288 60 15.00° -2288 60 15.00° -2288 60 15.00° -2288 60 15.00° -2288 60 15.00° -2288 60 15.00°	8897 2819 2819 2819 2819 2819 2819 2819 2819	801 801 801 801 801 801 801 801 801	2013-02.23 80 1937 2015-02.23 11 52:26 2015-09.42 14 22:95 2016-03.40 15 52:95 2016-03.40 15 52:95 2016-03.40 15 2016 2016-03.40 16 2016 2016-16 40 15 2016 2016-16 40 15 2016 2016-16 40 15 2016	2014 42 20 42 10 39 2014 42 20 42 10 39 2014 42 20 20 30 30 40 2014 45 40 20 10 10 40 2014 45 40 20 10 10 10 2014 45 40 20 10 10 2014 45 40 20 20 30 2014 10 40 20 20 20 2014 10 40 20 20 20 2014 10 40 20 20 20	7138 2046 11599 11779 8000 21600 20300 25900 8000	Teast Tase mic Code, org	August and a second secon	COMPOSED 201		C 053 3 Data 1 4 data 4 4 data 4 1 manuar
	*	CC Archives (C)	20 289 QUERES 289 QUERES 2000 2000 2000 2000 2000 2000 2000 20	Inter time in 8A 600 3400 2006	Bend table to BEC -228 40 15.07 -228 40 15.07 -228 40 15.07 -228 40 15.07 -228 40 15.07 -228 40 15.07 -228 40 15.07 -228 40 15.07 -228 40 15.07 -228 40 15.07 -228 40 15.07 -228 40 15.07 -228 40 15.07 -228 40 15.07 -228 40 15.07 -228 40 15.07 -228 40 15.07	a and	8.01 8.01 8.01 8.01 8.01 8.01 8.01 8.01	2011-02.23 00 1937 2011-02.23 1750-24 2011-09.42 34:25 95 2011-09.42 34:25 95 2011-09.42 34:25 95 2014-03.46 95 2016 2014-03.46 95 2016 2014-03.46 95 2016 2014-03.45 20 2024 2015-03.47 95 2014 2015-03.47 95 2014	2011 42 3 0 2 19 3 2011 42 3 0 2 19 3 2011 42 3 12 3 2 3 39 49 2015 49 42 19 10 19 2014 45 40 2 19 30 19 2014 45 40 2 2 19 30 19 2014 45 40 2 2 19 20 3 2014 45 40 2 19 20 30 2014 45 40 2 19 20 30 2014 45 40 19 10 10 10 2014 45 40 10 10 10 2014 45 40 10 10 2014 45 40 100 100 2014 45 40 1	7738 20948 17599 17779 8008 21808 20308 20308 2000 8009 8009 19776 19208	Taget Tage mic (AA),22	August and a second secon	COMPOSED 201		C 053 3 Data 1 4 data 4 4 data 4 1 manuar
XXMM-Newto Sectors 100 100 100 100 100 100 100 100	* * * * * * * * * * * * * * * * * * *	Control Control Contro Contro Control Control Control Control Co	Arrow Rouses Rerow Rouses Core One	Non-Main Non-Main 49.3 Mar. 12.056 40.4 49.3 Mar. 12.056 40.5 Mar. 12.056 49.3 Mar. 12.056 40.5 Mar. 12.056 49.3 Mar. 12.056 40.5 Mar. 12.056 40.5 Mar. 12.056 40.5 Mar. 12.056 40.5 Mar. 12.056 40.5 Mar. 12.056 40.5 Mar. 12.066 40.5 Mar. 12.066 40.5 Mar. 12.066 40.5 Mar. 12.066 40.5 Mar. 12.066 40.5 Mar. 12.066	Beec Beec -200 407 16.07 -200 407 16.07 -200 407 16.07 -200 407 16.07 -200 407 16.07 -200 407 16.07 -200 407 16.07 -200 407 16.07 -200 407 16.07 -200 407 16.07 -200 407 16.07 -200 407 16.07 -200 407 16.07 -200 407 16.07 -200 407 16.07 -200 407 16.07 -200 407 16.07 -200 407 16.07 -200 407 16.07 -200 407 16.07	2019 2019 2019 2019 2019 2019 2019 2019	8.01 8.01 8.01 8.01 8.01 8.01 8.01 8.01	2011-02.219.019837 2015-02.219.02982 2015-09-02.942998 2014-02-04.1792598 2014-02-04.1792598 2014-02-04.1792598 2014-02-04.1792598 2014-02-02.2008 2014-02-02008 2014-02-0208 2014-0208 2014-0208 2014-0208 2014-0208 2014-0208 2014-0208 2014-0208 2014-0208 2014-0208 2014-0208 2014-0208 2014-0208	2011 42 3 0 5 7 8 3 4 2013 42 3 0 5 7 8 3 4 2013 42 3 5 7 8 3 4 2015 49 42 11 4 1 1 2014 45 40 2013 10 2014 45 40 2014 10 2014 40 2014 10 2014 40 200 10 2014 40 200 10 2014 40 200 10 2014 40 200 1	7538 2048 1559 17779 8008 21806 20308 25908 20308 8000 90598 90598 90598 20208		August and a second secon	COMPOSED 201		C 053 3 Data 1 4 data 4 4 data 4 1 manuar
XXMM-Newton	A	ec Archita aso Acciss ec S or O O O O O O O O O O O O O O O O O O O O O O O O O	Attractions Attra	Barr Mart No. 400 104 12 (04)	Bend table to BedC -2016 40 10.07 -2016 40 10.07 -2016 40 10.07 -2016 40 10.07 -2016 40 10.07 -2016 40 10.07 -2016 40 10.07 -2016 40 10.07 -2016 40 10.07 -2016 40 10.07 -2016 40 10.07 -2016 40 10.07 -2016 40 10.07 -2016 40 10.07 -2016 40 10.07 -2016 40 10.07 -2016 40 10.07 -2016 40 10.07	2019 2019 2019 2019 2019 2019 2019 2019	8.01 8.01 8.01 8.01 8.01 8.01 8.01 8.01	2015-02.2130-19.37 2015-02.2135-02 2015-09-02.94.219-92 2015-09-02.94.219-92 2014-03-04-17.02.09 2014-03-04-17.02.09 2014-03-04.219-02 2014-04-04.219-04-04-04-04-04-04-04-04-04-04-04-04-04-	2015 42 20 52 10 52 10 55 2015 42 20 52 10 53 2015 42 20 52 10 50 2015 42 50 52 10 50 2014 55 42 20 80 10 2014 55 42 20 80 10 2014 55 42 20 20 50 2014 55 42 10 20 50 2014 55 42 10 20 50 2014 55 40 20 50 2014 50 50 2014 55 40 20 50 2014 55 40 20 50 2015 55 55 55 55 55 55 55 55 55 55 55 55 5	7158 20948 11599 117779 6000 21806 22800 25900 6000 155706 22800 22700 22800 22700		August and a second secon	COMPOSED 201		C 053 3 Data 1 4 data 4 4 data 4 1 manuar
	Consult In Science Consult In Science Consult In Science Consult In Science	ec Archive me me	Antio Roman Antio Roman Come Come Come Come Come Come Come Come	Non-Mark III BA 600-000-000	Bard Male In BEC -228 W 12/9	Ray 2419	8.01 8.01 8.01 8.01 8.01 8.01 8.01 8.01	2013-02.23 00 19837 2013-02.23 00 19837 2013-09.02 04 25 98 2014-03-04 17 58 98 2014-03-04 17 58 98 2014-03-04 17 58 98 2014-03-04 17 58 98 2014-04-02 59 2014-04-02 55 25 44 2014-04-05 2014 2014-04-05 2014 2014-04-05 2014 2014-04-05 2014	2013 42 20 52 103 2013 42 20 52 103 2014 40 52 52 103 2014 40 52 57 40 2014 40 42 103 2014 40 40 40 2014 40 40 2014 40 40 2014 40 40 2014 40	7158 20642 11599 11779 8008 21808 221808 20508 8009 90578 40808 10578 10808 21708 21708 21708		August and a second secon	COMPOSED 201		C 053 3 Data 1 4 data 4 4 data 4 1 manuar
	*	cc Archit ex 6 cc 3	CC DUFORMUT AND AND AND AND AND AND AND AND AND AND	Image: Section of the sectio	Bend Haller M BEC BEC -2018 MP 16,07 -2018	Any 2419	8.01 8.01 8.01 8.01 8.01 8.01 8.01 8.01	2014-23 89 192 0 2014-23 89 192 0 2014-2017 0 202 2014-00 2017 0 202 2014-00 2017 0 2014-00 2014 2014-00 2014 2014-00 2014-00 2014 2014-00 2014 2014-00000000000000000000000000000000000	2004/22 2004/2	7138 20945 11559 117776 21806 21806 21806 20036 20036 10558 20040 10558 20040 10558 20040 21738 20040 21738 20040 21738 20040 21738 20040 200000000		A A	COMPOSED 201		C 053 3 Data 1 4 data 4 4 data 4 1 manuar
		ec Archive me me	CC DUFORMUT AND AND AND AND AND AND AND AND AND AND	Max MA Chi Nen 20164	Energy Annual Annu	Base 2419	8.01 8.01 8.01 8.01 8.01 8.01 8.01 8.01	2014-22-10 H 10 ⁻¹ 2014-22-10 H 10 ⁻¹ 2014-04-01 H 2014 2014-04-01 H 2014 2014-04-	2014-22-02 2013/26 2013-22-02 2013/26 2013-26-02 2013/26 2014-26-02 2014/26 2014-26-02 2014/26 2014-26-02 2014-26-	7138 20645 11559		A A	COMPOSED 201		C 053 3 Data 1 4 data 4 4 data 4 1 manuar
		co Archild c	Arro barro Arro barro Case Case Case Case Case Case Case Case	Image: Control of the section of the sectio	Energy and a set of the set	Bare 2419	801 801 801 801 801 801 801 801 801 801	200423180192 200425101924 200425101924 200405101924 200405101926 200405101926 200405102020 200405102020 200405102020 200405102020 20040510100 200405101000 200405101000 200405101000		17538 20640 17599 17779 8000 21600 20500 20500 8000 1055000 105500 1055000 1055000 1055000 1055000 1055000 1055000 1055000 1055000 105500000000		A A	COMPOSED 201		C 053 3 Data 1 4 data 4 4 data 4 1 manuar

	scienc	e ait	:nive									100 40	and a		13.	C
RESUL	rs #1 ×	/											Q OBSERVA	TION: 1342211	1309 - SPIRE	-
Pipel	ne (10)	0P (8)	Publicat	iona (15)								H 4 *				1.89,91
1	Observation					Target name	54	Dec		Observing Hode	00 Proposal ID	AOR	0.000			
	1342211294		*	••	1		00h 38m 31.60y 00h 37m 39.12e	+406 02'	5264.518 PRC8	Tprettacs/tarallel	583 071_f=8#_1	SPParale) #31-6-94977-150+181				
10	1242211284				10.0		29.12e 00h 38m 31.60a	97.78 +40d 01' 06.52' +40d 02' 37.78'	5483,802 SP1R5 5264,518 PACS	SpirePaceParallel	582 GT1_W82_1 584 GT1_W82_1	SPParafiel #21-A-nomin-150x181 SPParafiel #21-A-nmo-181x150			1.	
10	1342211309		+				31.40s 00h 37m 39.07s	+404 01'	5604.513 SPIRE	SpinePacaParaltal	564 071_PHM_1	579ara8a) #31-8-ortho-181x150				
13	1342211319				10	121-8	00h 40m	+42.6 20' 37.38"	8727.403 8718.8	SpinePacsPanallel	545 071_Fea_1	8PPacaba) #31-8-10011010181	Summary Out	alla Publications		
8	1342211319		+		1		00h 40m 56.95a 00h 43m 54.66a	+42d 32' 29.43'	6199-723 9908	SpinePacaPanalal	583 071_F+W_1	579a-alia) 931-8-x0977-130x181	Observation 1d		1342211309	
	1342211404		*	11	10		005 43m 54.66s	+458 21' 07.04"	247.174 PACS	SpirePassPacatel	391 GTL_shrawar_4	N21 Jonus parala pres romina	Observing Hode		SpineParaParaHel 00h 37m 29.07s	
13	1342211404			***			01h 43m 02.27s 02h 43m 02.23s	+414 19' 12.05" +414 19' 11.67"	273.422 BPIRS	SpinePaceParallel	391 071_cicause_4	ND1_krause_parallel_press_noniva	040		+404 05' 08.09'	
13	1242211605		4	**	1		02.279 025.43m 94.869	+414 21'	\$47.174 RMCS	SpinePaceParaTel	581 GT1_chrases_4	RD1_krause_parallel_press_ontho	Target name		N31-A	
10	1342211606		+	-	10	*31	00h 43m 54.40x	+412 21'	848,084 8905	SpinePacsPanallel	591 071_oleana_4	R01_Insus_parallel_blue_nominal				
8	1342211408		۰	***	10		00h 42m 02.224	+410 19' 12.14"	273.546 8018.8	Novelta (stravalle)	391 071_oleana_4	921_kraves_parallel_klue_normal				
	1342211417		*	**	10		00h 43m 54.43s 00h 43m 02.10s	+41d 21' 16.52' +41d 19'	848.084 FACS	SpinePassPanallel	392 071_elesse_4	N31_ireze_peals(_bise_orbs				
0	1342211417		*	**	10		02.18x 05h 48m 56.95y	+416 19 11.32* +426 32 39.43*	272,445 SPIR6 6195,723 PH26	SpirePacePacaTel SpirePacePacaTel	592 GT1_582848_4 420 GT1_5984_1	Wit_krouse_parallel_blue_orbu SPParallel-Wit-&-arbu-181x131-re				
1	1342213207				1		00h 48m 00.76s	39.43' +426.30' 45.77'	5704.369 SPIRE	SpirePaceParafiel	420 OTL_MILL	DParallal #21-8-ortho-181x150-re				
11	1242247140		+		10	131-2	01h 42m 43.72s	+416.16" 31-14"	28.414 PACS	PacaLineSpec	1133 012_Jahijuan_2	PiperL-0011	-			
8	1342247149		Ψ.	: -	10	#31-1	00h 42m 45.70z	+41010' 21.00"	28.305 PHC5	PacaUneSpec	1155 072_labiyuan_2	PEpect-0000				
1				1				ł		S.		Dashaying 3-12-20-21				
a +)	nck Le			1	1			ž		å	23	Diskeys 1874		()	C e	sa
Pla	7			1				ž		ŝ		6		Contraction of the second seco	CC C 1 PR2 - 2015	sa
Pla	nck Le	gacy		1				×		ŝ		61			PR2 - 2015	•
Pla	nck Le	gacy	Alcl	nive	1	423 8	BOUNCTS (2)	151) # 99	IRIGE G2201 K	ŝ	28	61			PR2 - 2015	•
Pla	nck Le	gacy	Aicl	nive				511) X 500	m(cts (528)) ×	i a		61		R2 Catalogues #	PR2 - 2015	
Pla # q	nck Le	gacy	Aicl	nive		LNAME - TOO			UNICES (5220) X CLOB (Are	teed]	State (stages)	61	Explanatory Supp	R2 Catalogues #	PR2 - 2015	
Pla Pla		gacy surs source	Arct Ary x Ary x	nive		LNAME - PCC	3,2	r		(rent		Gard	Explanatory Supp press]	R2 Catalogues # Innet & d* DEC (4	ряд - 2015 -1 т	
Pla # q		gacy surs source	Arcl 473 #			LNAME = TPCC 1 PCCS2	S_2 ROUBCE NAME	t 40.05	GLON (deg	real	GLAT [degrees]	Citer E Citer E Citer	Explanatory Supp grows) 024	R2 Catalogues # Immet & df DEC (4 -28	: PR2 - 2015	
Pla # q		gacy surs source	Arct Ary x Ary x			PCCS2	5_2 FOLIRCE NAMI (130 GOOD.07	t 40.05 41.65	GLON (deg	(and the second s	GLAT [degrees] 059	Com Com 2005	Explanatory Supp proces] 024 200	R2 Catalogues # Immet & d* 58 DEC (# 28 22	PR2 - 2015	
Pla # q		gacy surs states	Arcl			ENAME = TPCC 1 POISI POISI POISI	5,2 ROURCE NAME 130 GOOD.07 830 GOOD.07	e 40.06 +81.65 +2.70	GLON (deg .067	ree]	GLAT (degrees) 	Свор Свор В. Свор В. Свор 2013 2013	Explanatory Supp press) 024 153	R2 Catalogues # Inment ♦ tP (3) DEC (4 28 22. 34	PR2 - 2015 1 PR2 - 2015 1 PR2 - 2015 2 1 PR2 - 2015 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	
Pla # q		gacy s (c)acy s (c)acy s (c)acy	Aici Aici Aici Aici Aici Aici Aici Aici	sound sound		EAUVE - TCC T POISE POISE POISE POISE	8_2 030 6000.07 030 6000.07	e 00.06 -01.05 -12.70 -56.33	GLON [deg .067 .008 .263		GLAT (degrees) 699 81.831 -12.701 -13.814	Cites Cites 265 265 265 265 265 265 265 265	Explanatory Supp press) 024 153	R2 Catalogues # Inment ♦ tP (3) DEC (4 28 22. 34	PR2 - 2015	
Pla # q		gacy surss states	Arct Arra X Arra	sound sound		POCS2 POCS2 POCS2 POCS3 POCS3 POCS3	5,2 ROLINCE NAME 030 6000.07 030 6000.07 030 6000.16	e 00.06 481.05 42.70 58.35 42.84	GLON [deg .067 .068 .169 .318		GLAT [degrees] .059 81.891 .12.701	Cites Cites 265 265 265 265 265 265 265 265	Explanatory Supp press) 024 153	R2 Catalogues # Inment ♦ tP (3) DEC (4 28 22. 34	PR2 - 2015	
Pla # q		gacy s (1)92 s	Aici Aici Aici Aici Aici Aici Aici Aici	sound sound		ENAME - Troc POSS POSS POSS POSS POSS POSS	 a) a constant 	e 40.05 +01.05 +02.70 +02.70 +03.35 +02.84 +05.99	GLON (dec 067 .563 .163 .318 .214		GLAT (degrees) 699 81.831 -12.701 -13.814	Cites Cites 265 265 265 265 265 265 265 265	Explanatory Supp press) 024 153	R2 Catalogues # Inment ♦ tP (3) DEC (4 28 22. 34	PR2 - 2015	
Pla # q		gacy states stat	Aici Aici Aici Aici Aici Aici Aici Aici	sound sound		EUUNE - 1900 90052 190052 190053 190053 190053 190052 190052	 2 3 3 4 4 5 5 6 7 7 8 9 9	e 40.05 41.65 42.70 42.84 45.99 20.95	GLON (deg .067 .363 .363 .363 .365 .24 .24		GLAT (degrees) 699 81.831 -12.701 -13.814	Cites Cites 265 265 265 265 265 265 265 265	Explanatory Supp press) 024 153	R2 Catalogues # Inment ♦ tP (3) DEC (4 28 22. 34	PR2 - 2015	
Pla # q		gacy states	Aici Aici Aici Aici Aici Aici Aici Aici	Soundaria		EXAMPLE - 1900 90053 90053 90053 90053 90053 90053 90053	5,2 500 KCC HAMI 500 6000.07 500 6000.07 500 6000.52 500 6000.57 500 6001.40 500 6001.56 500 6001.56	e 40.05 40.05 41.63 42.70 43.84 45.99 28.96 465.62	62.00 (deg 367 368 368 368 368 368 368 368 368 368 368		GLAT (degrees) 699 81.831 -12.701 6301 6303	Cites Cites 265 265 265 265 265 265 265 265	Explanatory Supp press) 024 153	R2 Catalogues # Inment ♦ tP (3) DEC (4 28 22. 34	PR2 - 2015	
Pla # q		gacy s (1362) s (1362	Arct Arch Arch Arch Arch Arch Arch Arch Arch	sound sound		ENAME - POC POCS2 POCS2 POCS2 POCS2 POCS2 POCS2 POCS2 POCS2 POCS2	5,2 600 600 07 600 600 07 600 600 16 600 600 12 600 600 52 600 600 140 600 600 140	t 40.06 +81.05 12.79 48.33 42.84 45.99 28.95 28.95 28.95 28.95 28.95	GLON (deg .047 .343 .345 .348 .344 .14 1.1570		GLAT (degrees) 699 81.831 -12.701 6301 6303	Cites Cites 265 265 265 265 265 265 265 265	Explanatory Supp press) 024 153	R2 Catalogues # Inment ♦ tP (3) DEC (4 28 22. 34	PR2 - 2015	
Pla # q		gacy s (1362 Sound) a a a a a a a a a a a a a a a a a a a	Arct Arch Arch Arch Arch Arch Arch Arch Arch	Sounded Ref Abb CA Ref Abb CA Sound		ENAME - POC 3 POCS3 POCS3 POCS3 POCS3 POCS3 POCS3 POCS3 POCS3 POCS3 POCS3 POCS3	5,2 COLECT HAMI 100 0000 07 100 0000 12 100 0000 12 100 0000 12 100 0001 40 100 0001 26 100 0002 26 100 0002 46	e 40.05 41.83 42.70 48.33 442.84 445.99 28.86 45.92 45.86 45.82 45.86 45.82	CLON (407 067 349 349 349 349 349 349 349 349 349 247 247 247 247 247 247 247 247 247 247		GLAT (degrees) 699 81.831 -12.701 6301 6303	Cites Cites 265 265 265 265 265 265 265 265	Explanatory Supp press) 024 153	R2 Catalogues # Inment ♦ tP (3) DEC (4 28 22. 34	PR2 - 2015	
Pla # q	nck Le		Arct More - 7 P P P P P P P P P P P P P P P P P P P	sound recently and recently and recently and recently and recently and recently and recently and recently and recently and		ENAME - POO 9 POOS2 POOS2 POOS2 POOS2 POOS2 POOS2 POOS2 POOS2 POOS2 POOS2 POOS2 POOS2	322 CREATE FAMILY 100 0000.07 100 0000.07 100 0000.07 100 0000.28 100 0002.28 100 0000.23 100 00000.23 100 0000.23 100 0000.23 100 0000.23 100 0000.2	t 40.05 41.83 42.70 42.84 42.84 445.99 28.86 45.92 45.85 45.	CLODY [deg 367 388 349 349 349 349 349 349 349 349 349 349		GLAT (degrees) 699 81.831 -12.701 6301 6303	Cites Cites 265 265 265 265 265 265 265 265	Explanatory Supp press) 024 153	R2 Catalogues # Inment ♦ tP (3) DEC (4 28 22. 34	PR2 - 2015	
Pla # q			Arcl	Sounded Ref Abb CA Ref Abb CA Sound		ENAME - POO 9 POOS POOS POOS POOS POOS POOS POOS	32,2 333 GOULD AND AND AND AND AND AND AND AND AND AN	r 40.05 41.65 12.70 56.33 42.84 45.09 42.84 45.09 45.02 45.0	CLODY [deg 367 388 388 388 388 388 388 388 289 289 289 289 289 289 289 289 289 2		GLAT (degrees) 699 81.831 -12.701 6301 6303	Cites Cites 265 265 265 265 265 265 265 265	Explanatory Supp press) 024 153	R2 Catalogues # Inment ♦ tP (3) DEC (4 28 22. 34	PR2 - 2015	
Pla # q	nck Le	S (1382) S (Arct Arct Arc Arc Arc Arc Arc Arc Arc Arc Arc Arc	sound recently and recently and recently and recently and recently and recently and recently and recently and recently and		ENAME = POC POCS3 POCS4 POCS4 POCS5 POC	322 CREATE FAMILY 100 0000.07 100 0000.07 100 0000.07 100 0000.28 100 0002.28 100 0000.23 100 00000.23 100 0000.23 100 0000.23 100 0000.23 100 0000.2	r 40.05 41.65 12.70 56.33 42.84 45.09 42.84 45.09 45.02 45.0	CLODY [deg 367 388 349 349 349 349 349 349 349 349 349 349		GLAT (degrees) 699 81.831 -12.701 6301 6303	Cites Cites 265 265 265 265 265 265 265 265	Explanatory Supp press) 024 153	R2 Catalogues # Inment ♦ tP (3) DEC (4 28 22. 34	PR2 - 2015	

esa

Multi- λ data visualisation/exploitation - ESASky

J2000 V



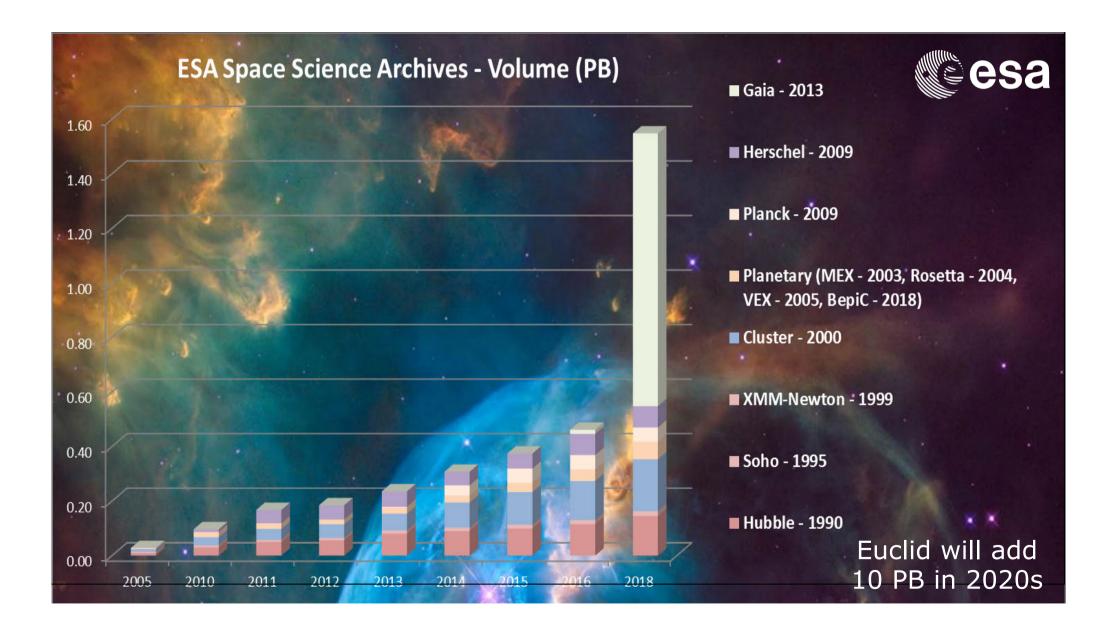
Search.

- ESASky: sky.esa.int
- Facilitate data discovery and archival science for ALL users
 - multi-wavelength,
 - project agnostic,
 - exploration.
- Interface "on top of" all ESA astronomy archives.

v: DSS2 co Messier 45 The Pleiades, are an open star cluster located in the constellation of Taurus. At a distance of 444 light years, it is one of the nearest star clusters to Earth and is the cluster most obvious to the naked eye in the night sky. It is dominated by hot blue and extremely luminous stars that have formed within the last 100 million years. A faint reflection nebulosity is seen around the brightest stars and comes from a dust cloud in the terstellar medium, through which the stars are currently passing. 0 SP. 1 ₹ ||| ? Welcome to ESASky! esa esa ESASky is an application that allows you to visualise and download public astronomical data from space-based mission<u>s.</u> Click on 🙀 to explore random targets in the sky or in 🧮 to see targets by class Video Tutorials 📃 Don't show this message again (uses cookies) Cesa ALADIN 5150 × × S Chandra GHerschel

Kessler | ESA's Science Operations Centre - ESAC | 25 May 2018 | Slide 20

💶 📕 🛌 📲 🛶 💵 💻 🔚 🔳 📕 📰 📰 🗮 🔤 💏 🚛 🔯 🖬 🖬 🖬 🔛 European Space Agency



Users and data

- > Then-ish & Now: "Bring the data to the user",
 - All data available for distribution,
 - > Install and run data analysis software locally.
- ➢ Now & Future: "Bring user code to the data",
 - User cannot download all data,
 - > Have user workspaces IN the archive,
 - User workspace and code shareable.

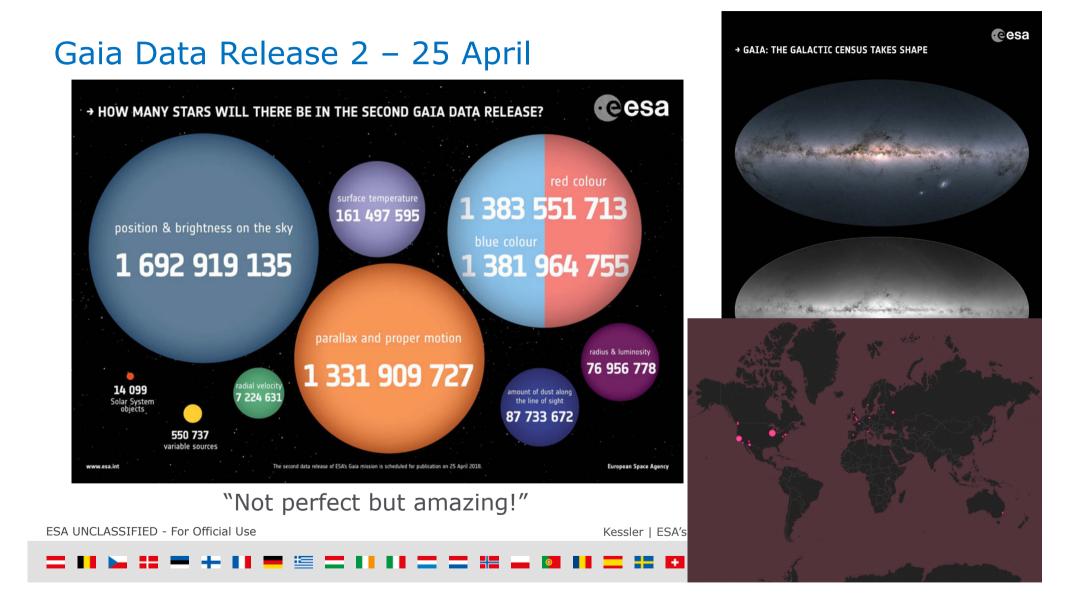




User works with the data WHERE the data is

```
=> Archive 2.0 concept
```



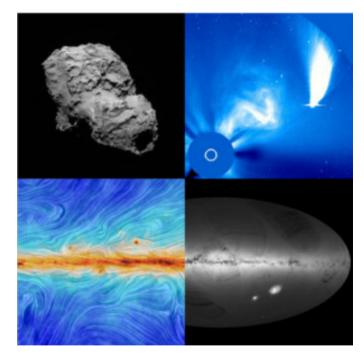


Then → Now: Summary of some Trends



European Space Agency

- > From centralised \rightarrow distributed science ground segments
- > From 'raw' data \rightarrow science ready products
- > From 'data to users' \rightarrow 'code to data'
- ➤ and others

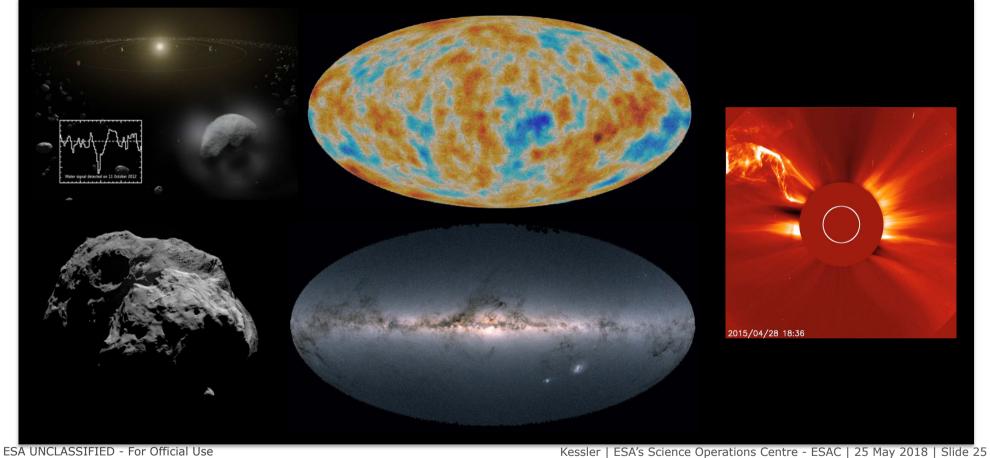


ESA UNCLASSIFIED - For Official Use

Kessler | ESA's Science Operations Centre - ESAC | 25 May 2018 | Slide 24

Then and Now: Why we do (science) operations





European Space Agency

