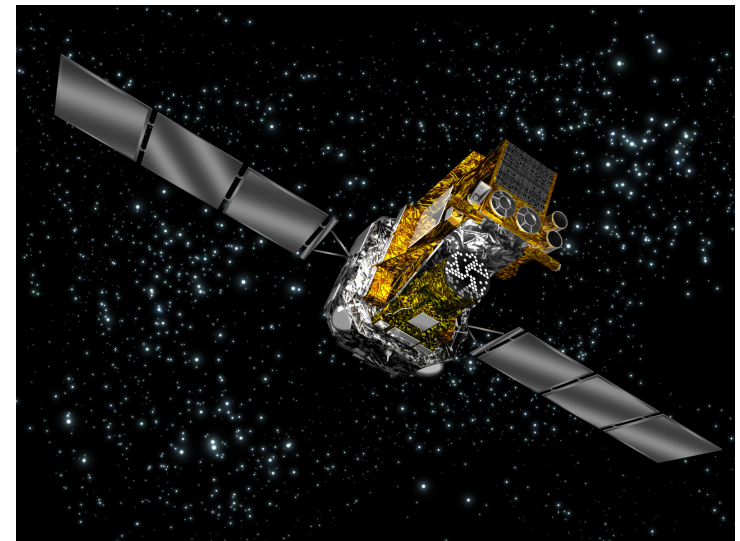




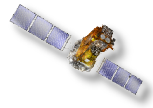
INTEGRAL

Project Scientist Report

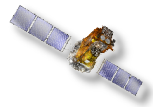
Erik Kuulkers
(ESA/ESTEC)



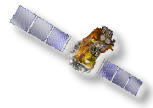
IUG Meeting #19 – ESTEC – 1 & 2 March 2017



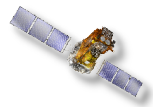
Community interfaces



Observatory status



Science highlights



Outreach

[INTEGRAL] Community interfaces



➤ Mike Revnivitsev * 3 MAY 1974 - 23 NOVEMBER 2016 *



2011-2015:
IUG
member

[INTEGRAL] Community interfaces



➤ Neil Gehrels * **3 OCTOBER 1952 - 6 FEBRUARY 2017** *



1995-2017:
INTEGRAL
mission
scientist

IUG Meeting #5, 15+16 November 2007, ESTEC



European Space Agency



- Not attending today (i.e., absence notified):
Angela Malizia, Miguel Mas Hesse, Norbert Schartel, Diego Torres, Ed van den Heuvel
- IUG Invitees 1 March: L. Kuiper, L. Natalucci, V. Savchenko, R. Southworth

- IUG member since July 2016:
Diego Götz (CEA-Saclay, France)
Angela Malizia (INAF-IASF Bologna, Italy)
Diego Torres (IEEC-CSIC, Spain)



Goodbye Tony Bird, Lorraine Hanlon and Dieter Hartmann!

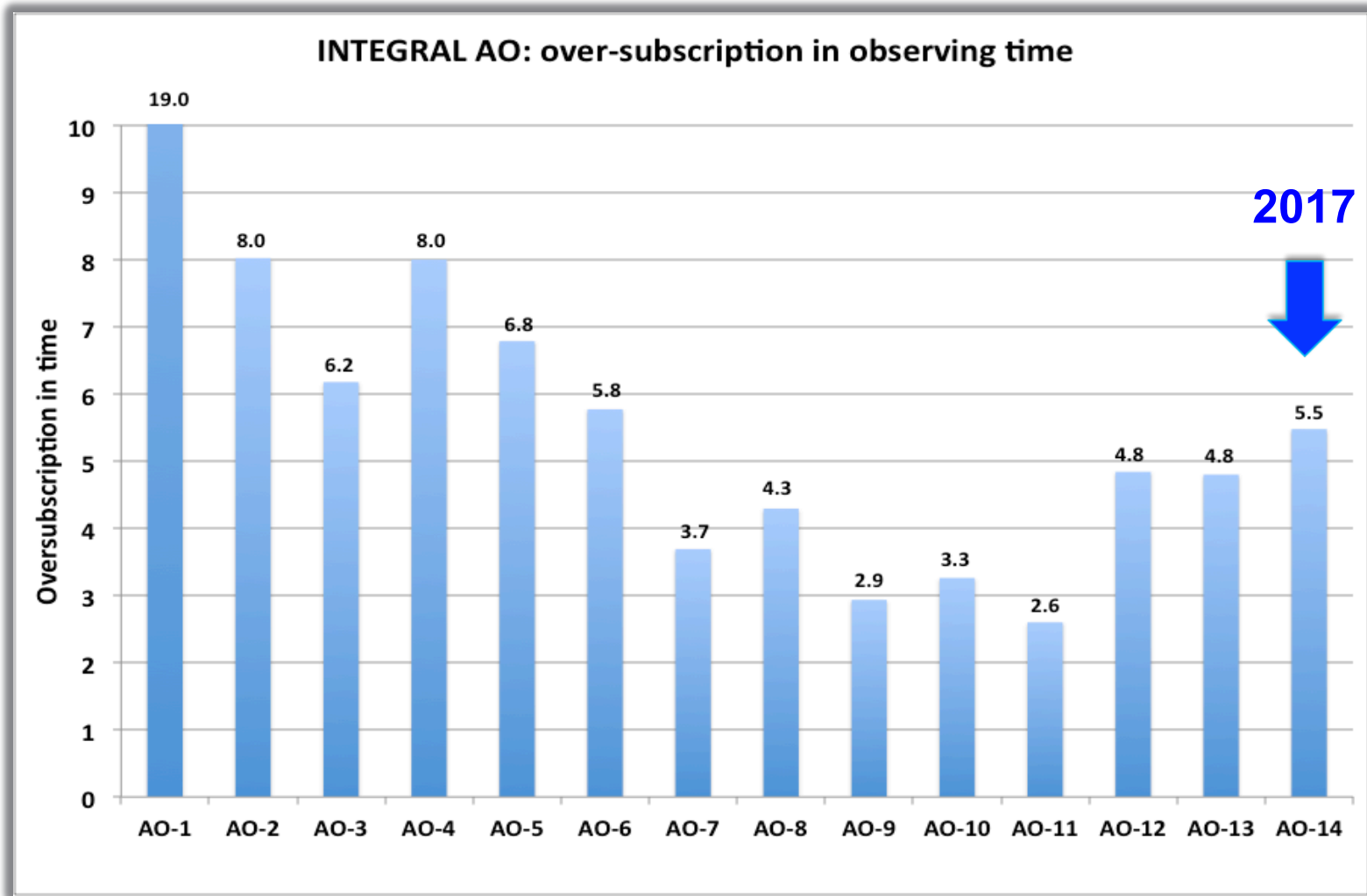


- Mission Scientist: Wim Hermsen re-appointed for 3 years from June 2016
- Carlo Ferrigno: from May 2016, main responsible for all contractual relations regarding INTEGRAL with ISDC (was Thierry Courvoisier)



Updates since last meeting

- April/May 2016: AO-14 [AO-13] call: 57 [62] proposals received (31 [30] normal, data rights on 359 [292] sources & 26 [32] ToO); oversubscription 5.5 [4.8]. **Next slide.** TAC granted 153 ks of Swift time to 5 INTEGRAL proposals. No NuSTAR time granted. XMM-Newton not requested.
- Because of the tension between the results on an event reported by the Fermi-GBM team seen close in time of GW150914 and the non-detection by INTEGRAL SPI/ACS, a joint investigation is ongoing
- 31 May: successful MEOR. All (co-)PIs, except for JEM-X, attended.
- 13 October: INTEGRAL 2016 extension science case presentation for the AWG on 13 October with EK and Ed van den Heuvel. At its 152nd meeting, the SPC confirmed the 2-year (2017 & 2018) extension for INTEGRAL. [Hurray!] Thank you all for the support! Extension for 2019 & 2020 will be discussed in June 2017.
- 10–14 October 2016: 11th INTEGRAL Conference "Gamma-Ray Astrophysics in Multi-Wavelength Perspective", Amsterdam. >100 registered participants. Proceedings of Science (deadline 1 April). Next INTEGRAL Conference (2018): Switzerland
- French (CNES) funding zero for 2017+; discussion on strategies for successful extension



➤ 2017: INTEGRAL serves 44 (293) unique PI's (+co-I's)



Near future

- AO-15 Observing Time proposals:
 - Release of AO-15: call for proposals: **20 February 2017**
 - Deadline for submission of proposals: **31 March 2017 (14:00 CEST)**
 - Meeting of the TAC: **15-17 May 2016**
 - Start of AO-15 cycle of observations: **1 January 2018**

- Coordination:
 - XMM-Newton (300 ksec), Swift (150 ksec), & NuSTAR (100 ksec) [& Fermi through their AO]
 - Notified INTEGRAL users, HEAD, Swift/NuSTAR community
 - Notified Chinese/Indian/Japanese high-E community
 - More ideas to foster cooperation & INTEGRAL awareness?!
 - ❖ Workshop on Astrophysics Mission Synergy at Caltech - March 31st, 2017:
Gather together with researchers and operations staff to discuss the synergy between current and planned missions and observatories



➤ MoU's

- 7 April 2014. INTEGRAL Project has signed a Memorandum of Understanding (MoU) with LIGO/Virgo consortium to participate to EM follow-up campaign of GW signals until 1 June 2017; renewal to be discussed soon. Liaison: C. Ferrigno.
- 25 October 2016. MoU signed with IceCube collaboration to receive their private multiplet* alerts and to establish close collaboration. Liaison: E. Kuulkers.
- Possible (Letter of Intent) LoI on FRBs (via Marta Burgay, INAF)?
Coordination: A. Bazzano/F. Panessa/E. Kuulkers?

Discussions on prospects of finding (high-energy) EM counterparts to GW events and ultra-high energy neutrino events with INTEGRAL + observing strategies for (quick) follow-up observations

* The IceCube collaboration releases publicly single-track events (i.e., 1 neutrino creates a track in the IceCube detector. Neutrino multiplets are defined as 2 or more neutrino track events arriving within 100 sec and have an angular separation of <3.5 deg. The rate is about 6-7/year. So, these are basically fast events, possibly associated with GRBs or AGN flaring



Community interfaces



Observatory status



Science highlights



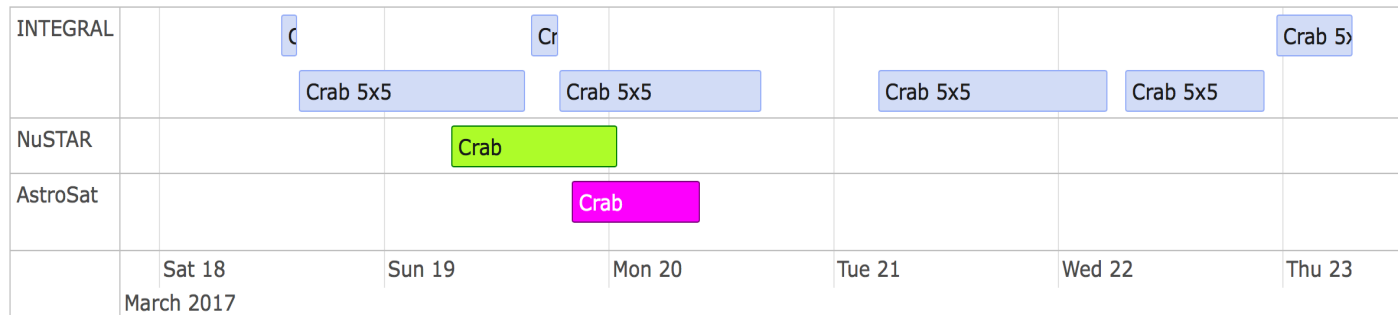
Outreach



Update since last meeting

- SPI annealing: #26 (3/3-18/3 2016), #27 (23/7-7/8 2016), #28 (14/1-30/1 2017)
- Cross-calibration observations with: Astrosat, NuSTAR (e.g., Cyg X-1, Crab)...
- Coordinated observation with Chandra, NuSTAR, Swift and XMM-Newton on 3C273 (June 2016) & with NuSTAR and Swift on Her X-1 (August 2016) & with NuSTAR, Swift, Astrosat (March 2017)

Coordinated Crab Observations



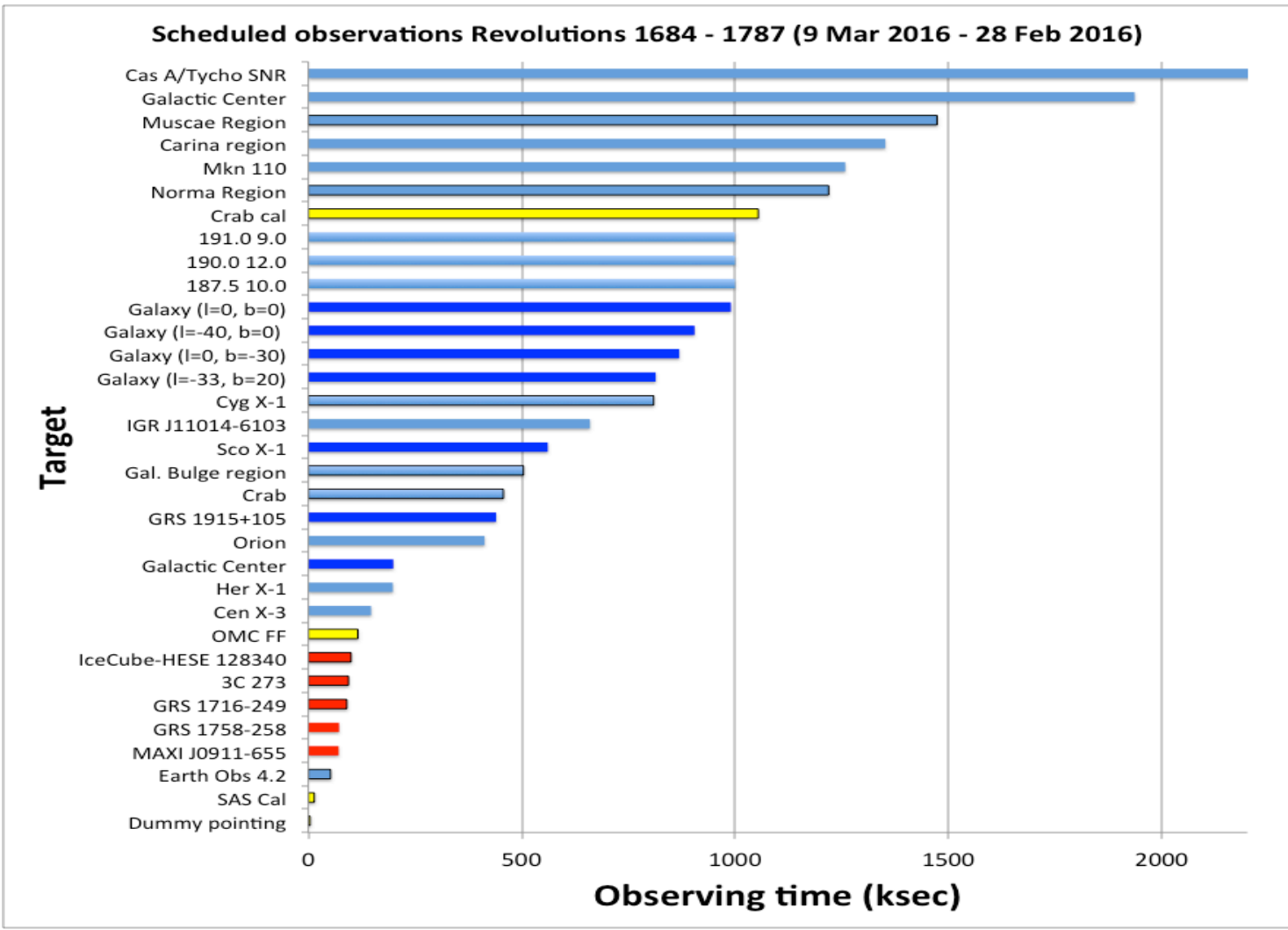
- Process to share spacecraft operations from ESOC for INTEGRAL, XMM-Newton and Gaia in the future is in progress. Leads to significant savings in cost with some loss in efficiency for the execution of INTEGRAL science operations.



Update since last meeting (continued)

- 11/12 May 2016: Earth-occultation observation (EO4.2) went smooth
But: JEM-X and IBIS/ISGRI light curves show strong and fast variability → not good for CXB study → uncertainties linked to space weather as well as Earth auroral activities + considerable planning effort at MOC/SOC: no EO's for 2nd half of 2016 & 2017
- 15 July: 1st version of ESASky (<http://sky.esa.int>) released to INTEGRAL community.
Contains high-level, science-ready, public imaging data products & source catalogues for INTEGRAL, XMM-Newton, Suzaku, HST, ISO, Herschel & Planck. Currently version 1.4.
- 11 November: new and improved OMC flat-field observation performed successfully
- 18 January 2017: ESAM #6, triggered by a star tracker anomaly
- 8 GRBs in FOV: GRB 160401A , GRB 160521A , GRB 160629A, GRB 161010A, GRB 161020A, GRB 161023A, GRB 161214A, GRB 161219A
- Russian return:
 - In AO-1–AO-13 ISOC scheduled 295.3 Msec GO and KP time & 74.2 Msec of Russian time
 - Official Russian return = 76.4 Msec → Total underreturn of 2.2 Msec
 - ISOC will intend to compensate this either in AO-14 and/or AO-15, whenever possible:
e.g., few gaps in our AO-14 LTP (Apr/May + Oct/Nov) → fill with Russian targets

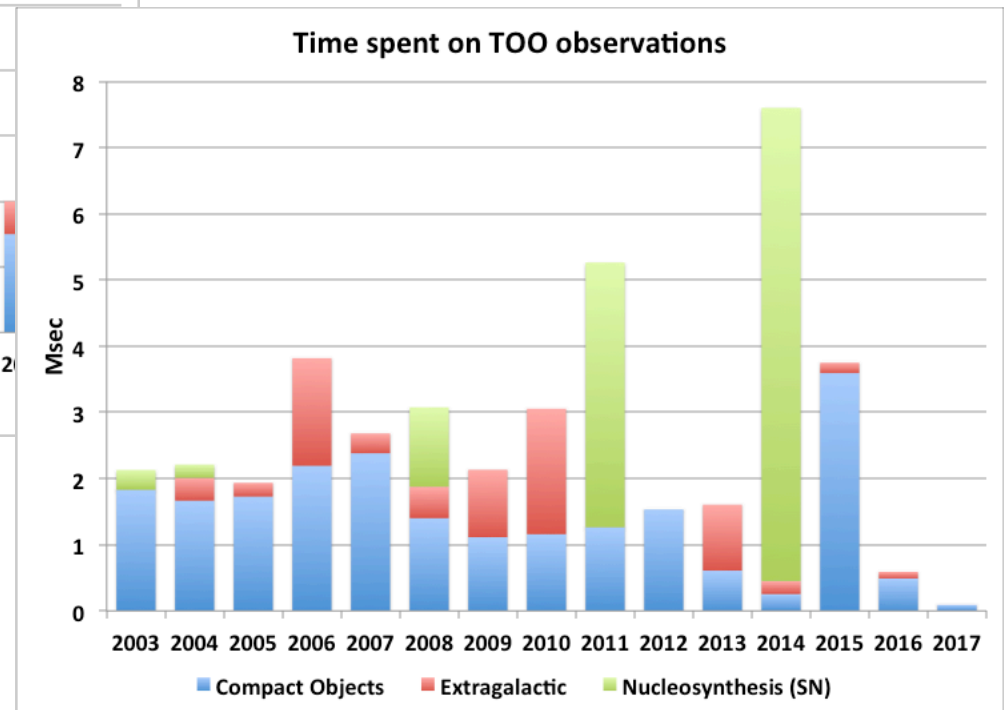
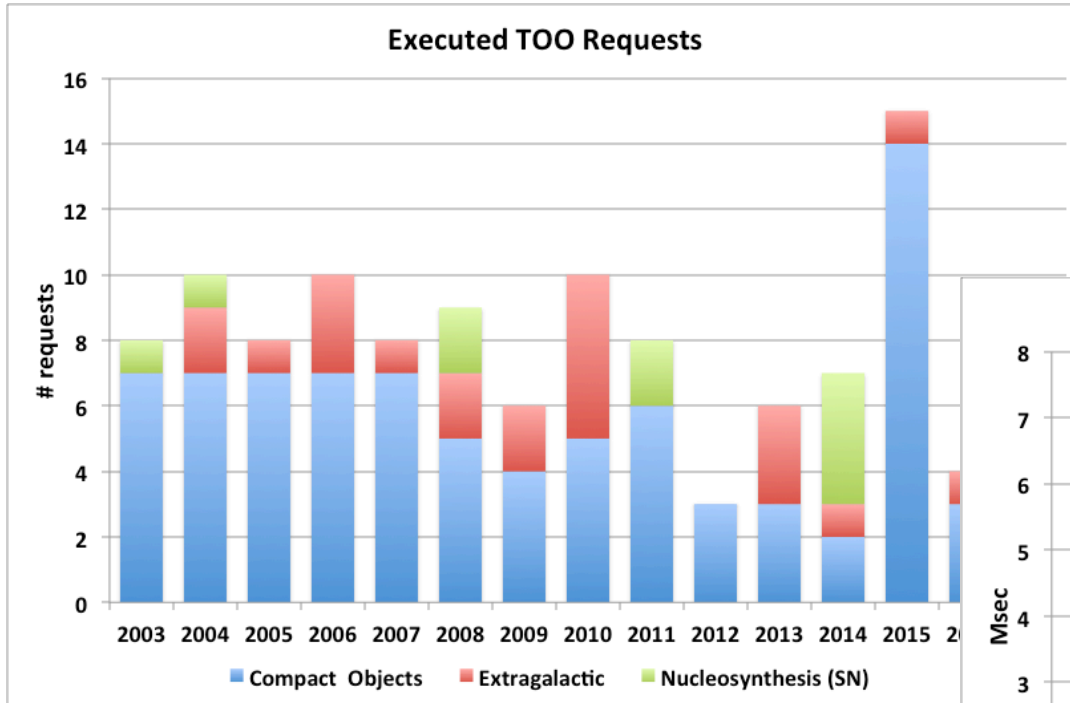
[INTEGRAL] Observatory status



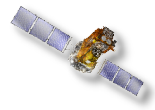
- Normal
- ToO
- Russian
- Calibration
- Public



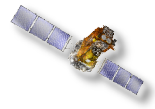
INTEGRAL ToOs (up to March 2017)



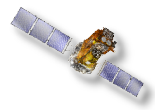
➤ 2015: 5 ToO requests on V404 Cyg



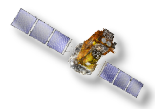
Observatory status



Community interfaces



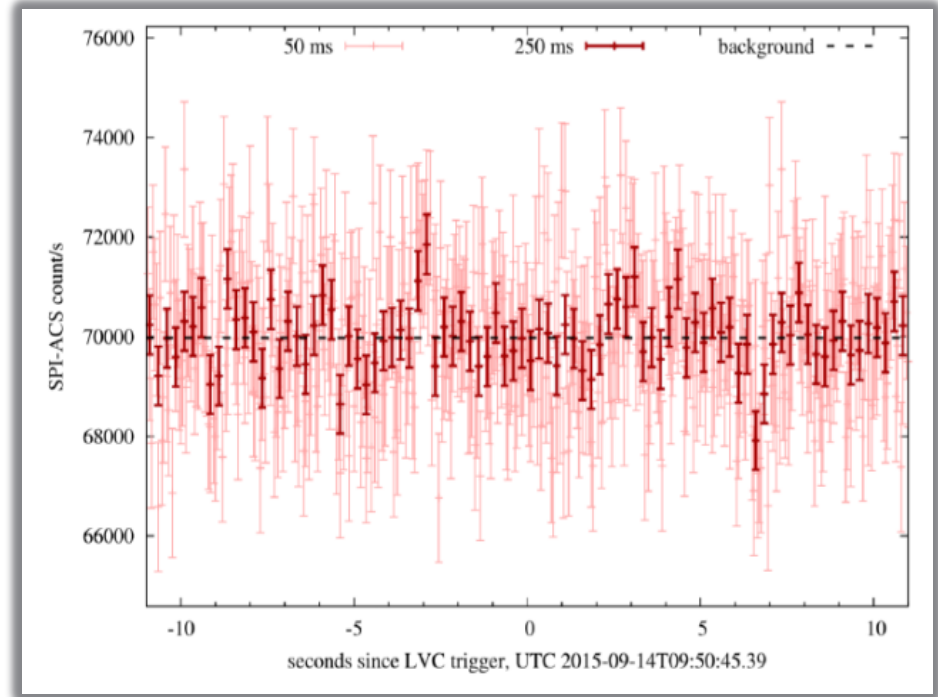
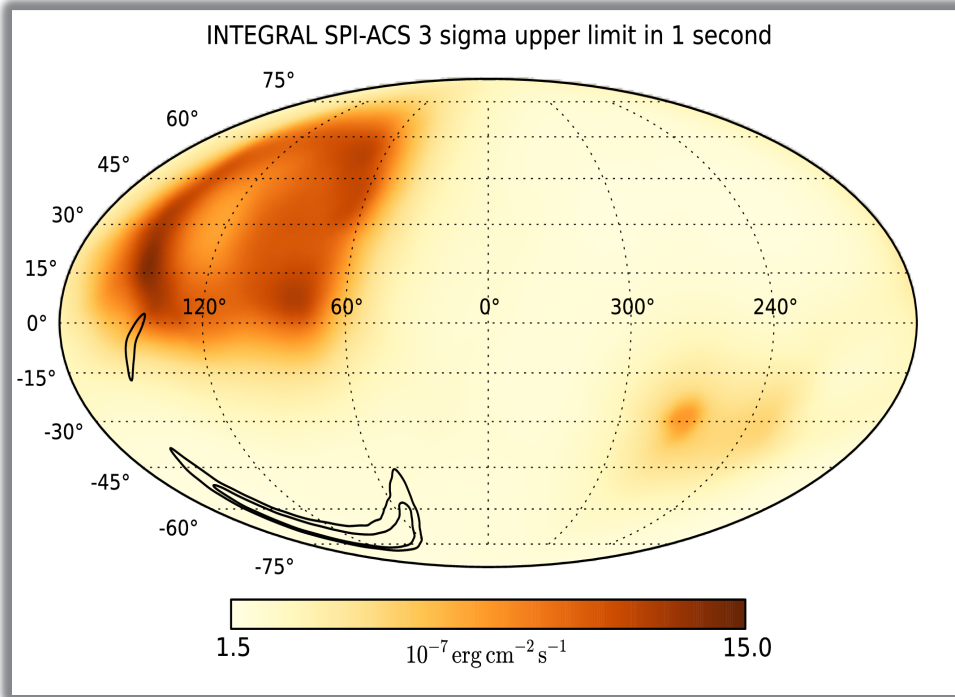
Science highlights



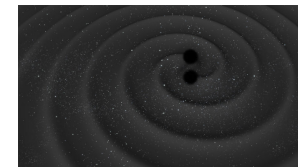
Outreach



Savchenko et al. 2016, ApJ 820, L36

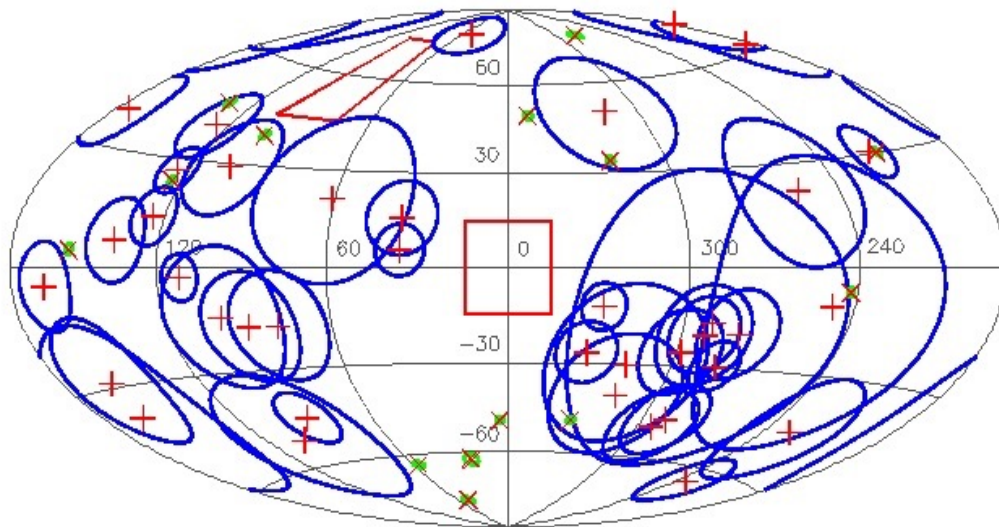


- INTEGRAL sets stringest limits on gamma-rays associated with GW150914 (despite claims for EM radiation by Fermi/GBM):
Signal $< 10^{-6}$ E (GWs) in domain 75 keV – 2 MeV (SPI)
→ just as models of two merging black holes predict!



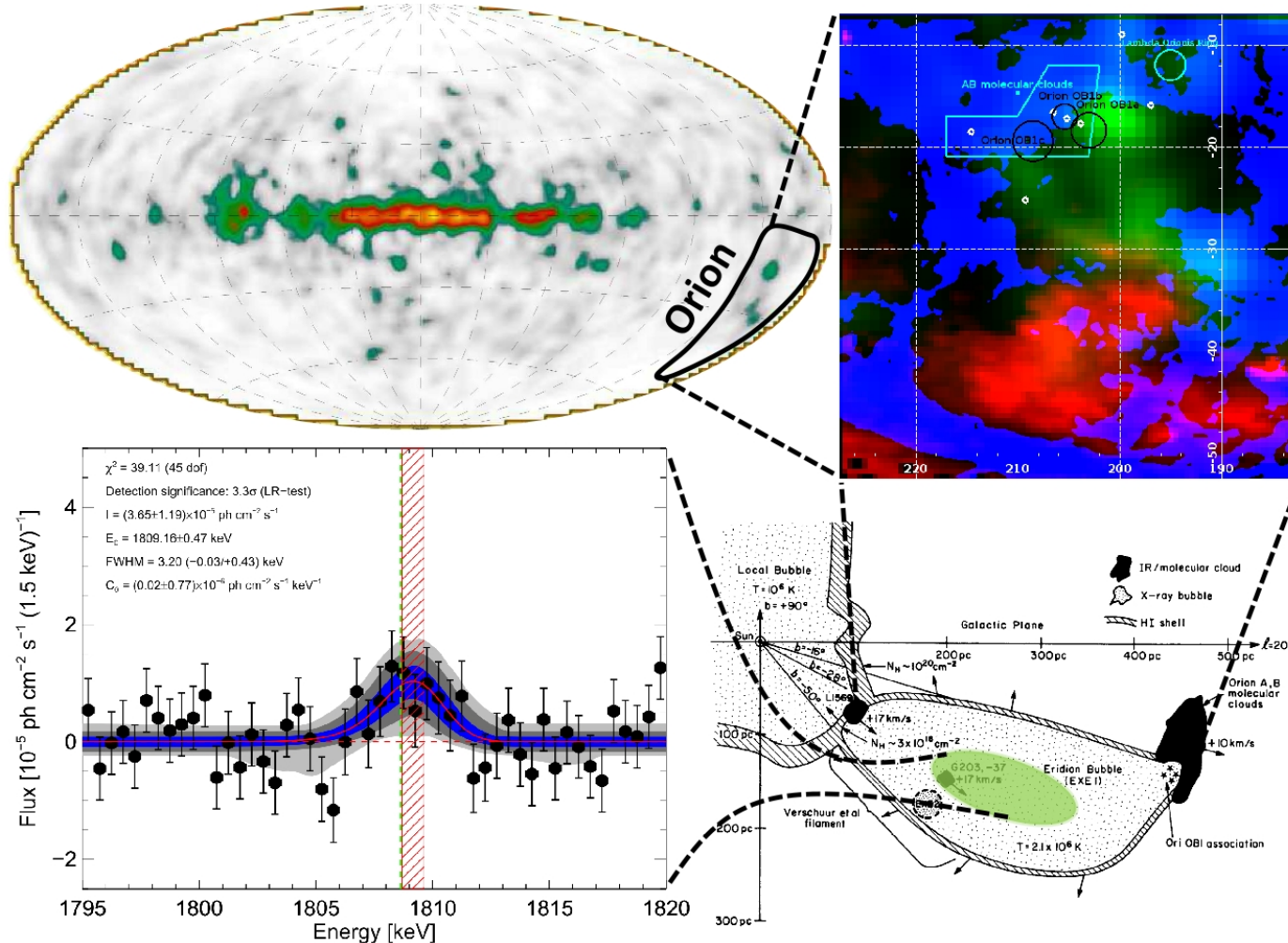
SSAC & SPC
June 2016

- Arrival directions of 54 ultra-high energy neutrinos observed in 2010-2014 by the IceCube detector



2016 INTEGRAL extension case

- 14 Aug 2016 21:46 IceCube observed high-energy neutrino event likely of astrophysical origin, HESE 128340 58537957. Using SPI/ACS no significant high-energy transient in coincidence with the event was found (Savchenko et al. 2016, GCN Circular 19828).
- INTEGRAL performed a pointed ToO observation of the region, starting only 36 hours after the event, with a total on-target time of 100 ksec. No significant new sources were found in FOV of both IBIS/ISGRI and JEM-X (Savchenko et al. 2016, Atel #9391)



➤ detection of ^{26}Al gamma rays from Orion region with INTEGRAL/SPI

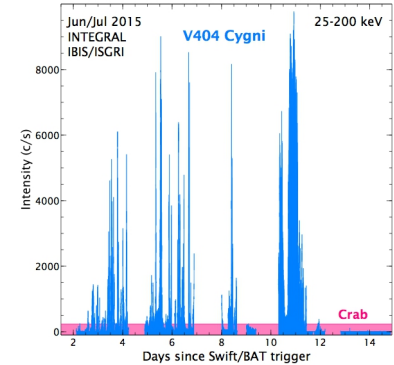
Siegert & Diehl 2016,
arXiv:1609.08817
INTEGRAL POM January 2017

INTEGRAL POM:
<http://www.cosmos.esa.int/web/integral/pom-archive>

SSAC & SPC
Feb 2017



- Remember 2015: ToO on V404 Cyg (total 2.1 Msec)
- Most of the data public immediately + ready-to-go data products



From last meeting: V404 Cyg - INTEGRAL-related publications

Title	Reference
Correlated optical, X-ray, and γ -ray flaring activity seen with INTEGRAL during the 2015 outburst of V404 Cygni	Rodriguez et al. 2015, A&A 581, L9
High Energy Spectral Evolution of V404 Cygni during the 2015 June Outburst as Observed by INTEGRAL	Natalucci et al. 2015, ApJ 813, L21
First INTEGRAL Observations of V404 Cygni during the 2015 Outburst: Spectral Behavior in the 20-650 keV Energy Range	Roques et al. 2015, ApJ 813, L22
Repetitive patterns in rapid optical variations in the nearby black-hole binary V404 Cygni	Kimura et al. 2016, Nature 529, 54
The X-ray dust-scattered rings of the black hole low-mass binary V404 Cyg	Vasilopoulos & Petropoulou 2016, MNRAS 455, 4426
Positron annihilation signatures associated with the outburst of the microquasar V404 Cygni	Siegert et al. 2016, Nature 531, 431



V404 Cyg - INTEGRAL-related publications, continued (2016)

Title	Reference
No Evidence of Intrinsic Optical/Near-infrared Linear Polarization for V404 Cygni during Its Bright Outburst in 2015: Broadband Modeling and Constraint on Jet Parameters	Tanaka et al. 2016, ApJ 823, 35
Furiously fast and red: sub-second optical flaring in V404 Cyg during the 2015 outburst peak	Gandhi et al. 2016, MNRAS 459, 554
Regulation of black-hole accretion by a disk wind during a violent outburst of V404 Cygni	Muñoz-Darias et al. 2016, Nature 534, 75
A Joint Chandra and Swift View of the 2015 X-ray Dust-scattering Echo of V404 Cygni	Heinz et al. 2016, ApJ 825, 15
SWIFT view of the 2015 outburst of GS 2023+338 (V404 Cyg): complex evolution of spectral and temporal characteristics	Radhika et al. 2016, MNRAS 462, 1834
High-energy gamma-ray observations of the accreting black hole V404 Cygni during its 2015 June outburst	Loh et al. 2016, MNRAS 462, L111
Evidence for magnetic field compression in shocks within the jet of V404 Cyg	Shahbaz et al. 2016, MNRAS 463, 1822

➤ Total 2015: 3 – Total 2016: 10



V404 Cyg - INTEGRAL-related publications, continued (2017)

Title	Reference
Detection of Very Low-frequency, Quasi-periodic Oscillations in the 2015 Outburst of V404 Cygni	Huppenkothen et al. 2017, ApJ 834, 90
A Challenging View of the 2015 Summer V404 Cyg Outburst at High Energy with INTEGRAL/SPI: The Finale	Jourdain et al. 2017, ApJ 834, 130
Flares, wind and nebulae: the 2015 December mini-outburst of V404 Cygni	Muñoz-Darias et al. 2017, MNRAS 465, L124
The nova-like nebular optical spectrum of V404 Cygni at the beginning of the 2015 outburst decay	Rahoui et al. 2017, MNRAS 465, 4468
The black hole binary V404 Cygni: an obscured AGN analogue	Motta et al. 2017, MNRAS, in press [arXiv:1607.02255]
Hard X-ray variability of V404 Cyg during the 2015 outburst	Sanchez-Fernandez et al. 2017, A&A, submitted [arXiv:1608.08802]
Living on a Flare: Relativistic Reflection in V404 Cyg Observed by NuSTAR During its Summer 2015 Outburst	Walton et al. 2017, ApJ, submitted [arXiv:1609.01293]
High-precision optical polarimetry of the accreting black hole V404 Cyg during the 2015 outburst	Kosenkov et al. 2017, MNRAS, submitted [arXiv:1702.02008]

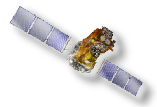
➤ Total 2017: >8

[INTEGRAL] Science highlights (POM)

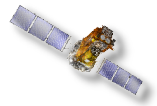


Title	Reference	POM
The Galactic ^{26}Al Emission Map as Revealed by INTEGRAL SPI	L. Bouchet et al. 2015, ApJ 801, 142	March 2015
The ephemeris, orbital decay, and masses of 10 eclipsing HMXBs	M. Falanga et al. 2015, A&A 577, A130	May 2015
Anatomy of the AGN in NGC 5548. I & III	M. Mehdipour et al. 2015, A&A, 575, A22 & F. Ursini et al. 2015, A&A, 577, A38	June 2015
Central engine of a gamma-ray blazar resolved through the magnifying glass of gravitational microlensing	A. Neronov et al. 2015, NatPh 11, 664	August 2015
A recent change in the optical and γ -ray polarization of the Crab nebula and pulsar	P. Moran et al. 2016, MNRAS 456, 2974	January 2016
JEM-X/INTEGRAL X-ray Survey of the Galactic Center Region	S.A. Grebenev & I.A. Mereminskiy 2015, AstL 41, 765	March 2016

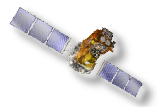
INTEGRAL POM: <http://www.cosmos.esa.int/web/integral/pom-archive>



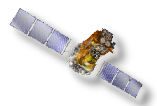
Observatory status



Community interfaces



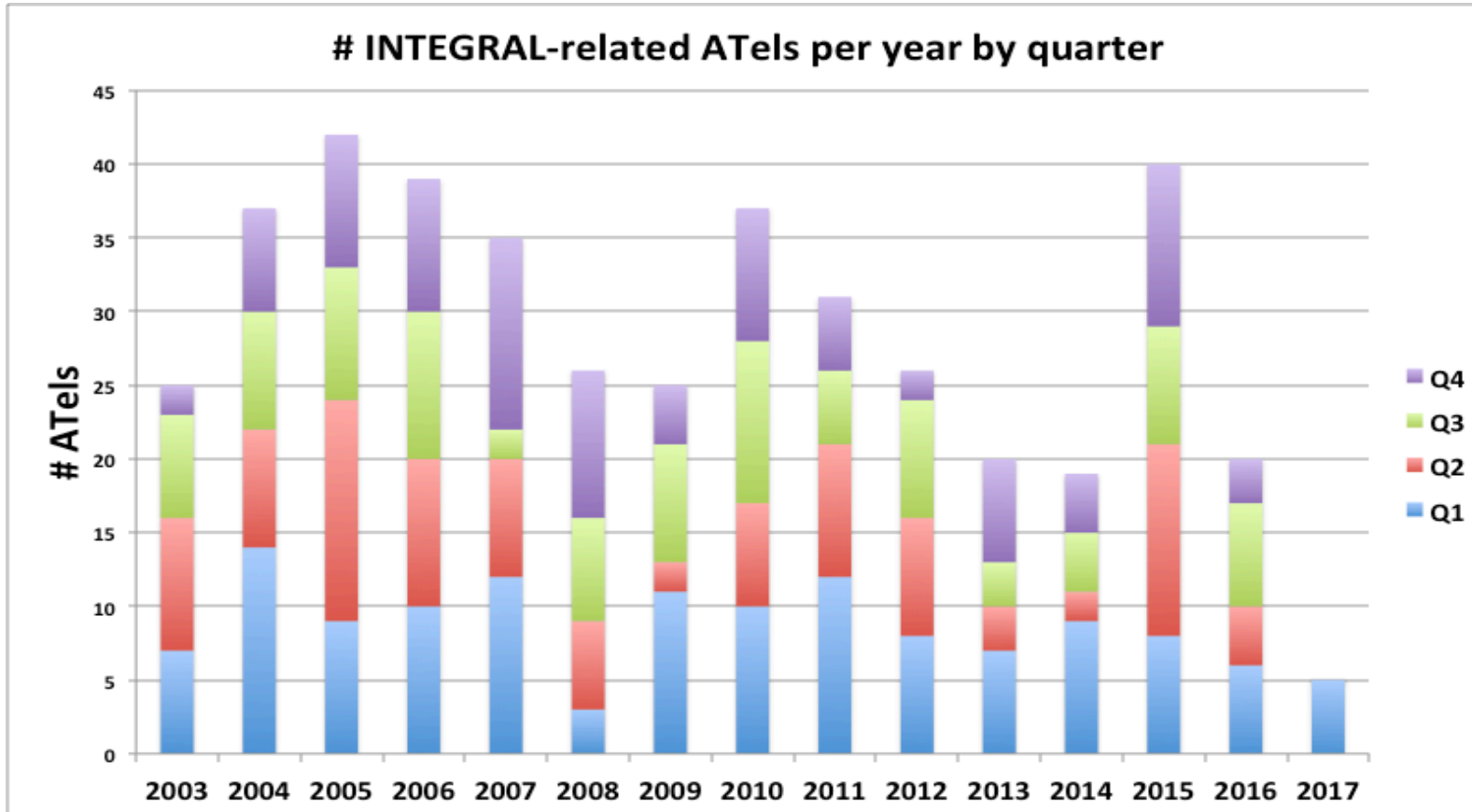
Science highlights



Outreach



ATel publication rate (up to/including Jan 2016)



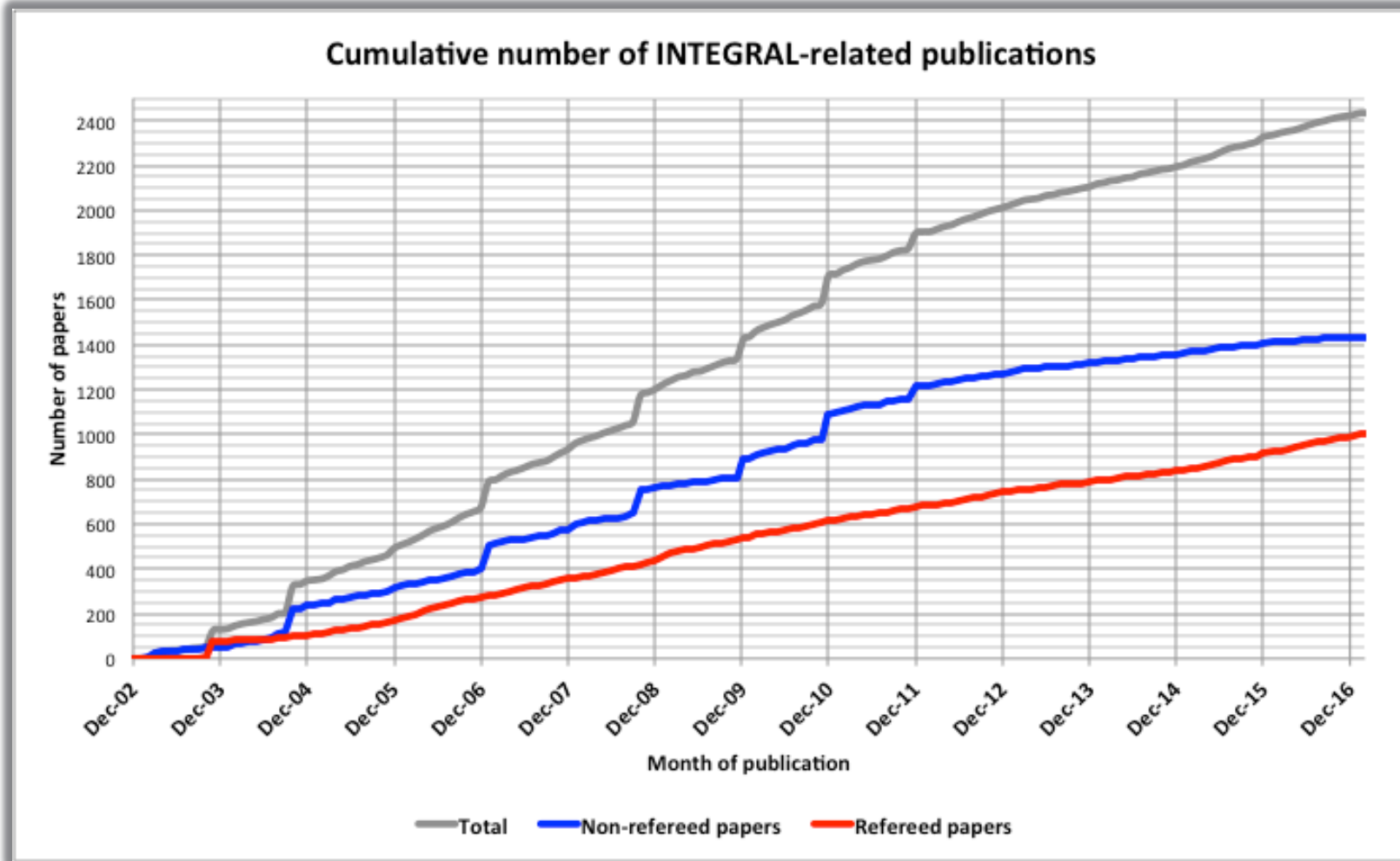
ATel total:
~100/month

INTEGRAL:
~2.5/month

➤ 2015: out of 40 INTEGRAL-related ATels → 11 on V404 Cyg!



Refereed publication statistics (up to/including Jan 2016)



2434

1434

1000 !





Paper 1000!

THE ASTROPHYSICAL JOURNAL, 834:130 (8pp), 2017 January 10

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[doi:10.3847/1538-4357/834/2/130](https://doi.org/10.3847/1538-4357/834/2/130)



CrossMark

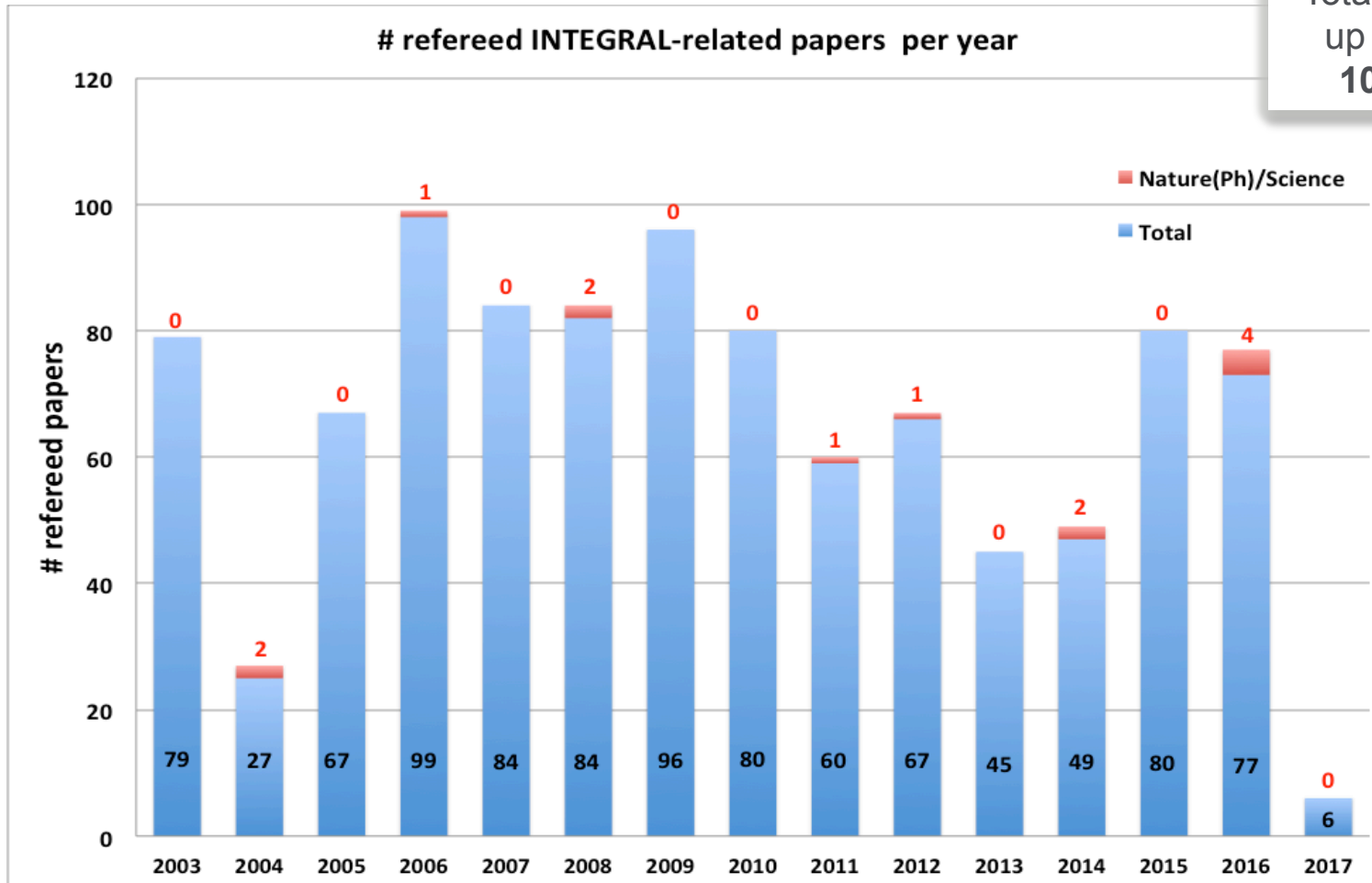
A CHALLENGING VIEW OF THE 2015 SUMMER V404 CYG OUTBURST AT HIGH ENERGY WITH *INTEGRAL*/SPI: THE FINALE*

ELISABETH JOURDAIN, JEAN-PIERRE ROQUES, AND JAMES RODI

Université Toulouse; UPS-OMP; CNRS; IRAP; 9 Avenue Roche, BP 44346, F-31028 Toulouse, France

Received 2016 August 12; revised 2016 November 8; accepted 2016 November 8; published 2017 January 9





Total since launch, up to Feb 2017: **1000** refereed

Note:
2015 & 2016
using ADS/Beta
(Bumblebee)

➤ 2015-2017: 15 papers using V404 Cyg public data!



Status since last meeting (9+10 March 2016)

ESA's INTEGRAL-related web-stories	
INTEGRAL X-rays Earth's aurora (Churazov, Türler et al.)	26 January 2016
INTEGRAL sets limits on gamma rays from merging black holes	30 March 2016
Two-year extensions confirmed for ESA's science missions	22 November 2016

Average # stories in:

2016	-	3
2015	-	3
2014	-	1
2013	-	4
2012	-	7
2011	-	9

+ Twitter!
+ Twitter!



Suggestions and proposals for new outreach products welcome!
(not only Nature or Science papers...)



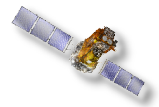
17 October 2017: 15 years in space!

- ESA: 15 years of INTEGRAL operations brochure
→ based on extension document?
- INTEGRAL infographic as a new outreach product (could also be used for brochure) → examples:
 - dimensions and weight of the spacecraft
 - size of the orbit, integrated distance travelled
 - how much observing time
 - how many sources observed
 - most powerful sources
 - nearest source / furthest source
 - fastest/slowest/weirdest source
 - how many publications (~1000)
 - and anything else that comes to mind...
- '15 years INTEGRAL Workshop : Energetic Time Domain Astrophysics', 16-20 October 2017, Venice, Italy → PU

Inputs by
31 March

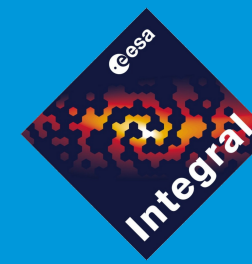
Suggestions,
proposals &
help welcome!





Miscellaneous

[INTEGRAL] Dinner tonight

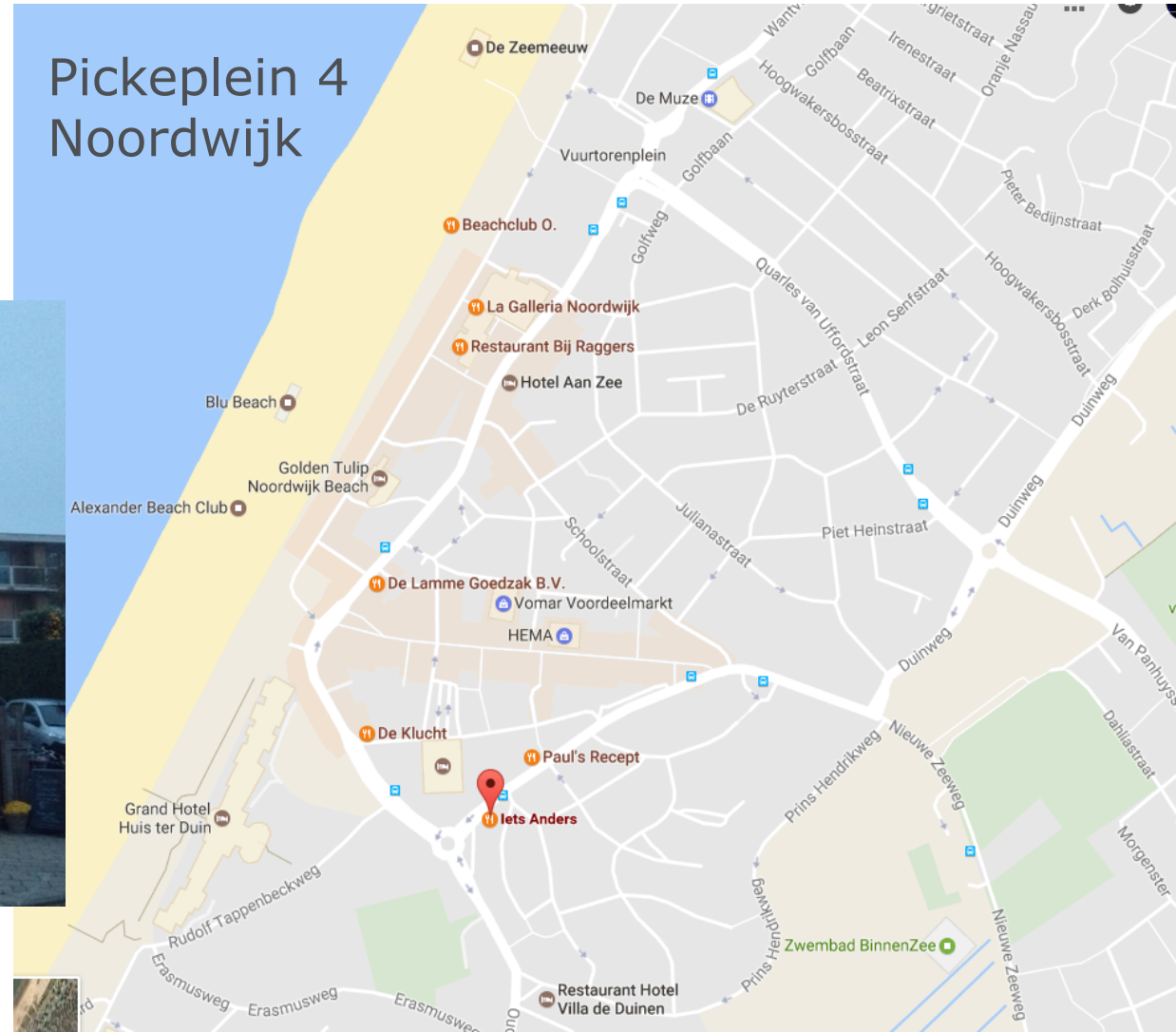


Grill Restaurant "Iets Anders"

A great no-nonsense bistro with honest, delicious food
<http://grillrestaurant-ietsanders.nl>



Pickeplein 4 Noordwijk



19:00

Who's joining?

[INTEGRAL]



That's it for now