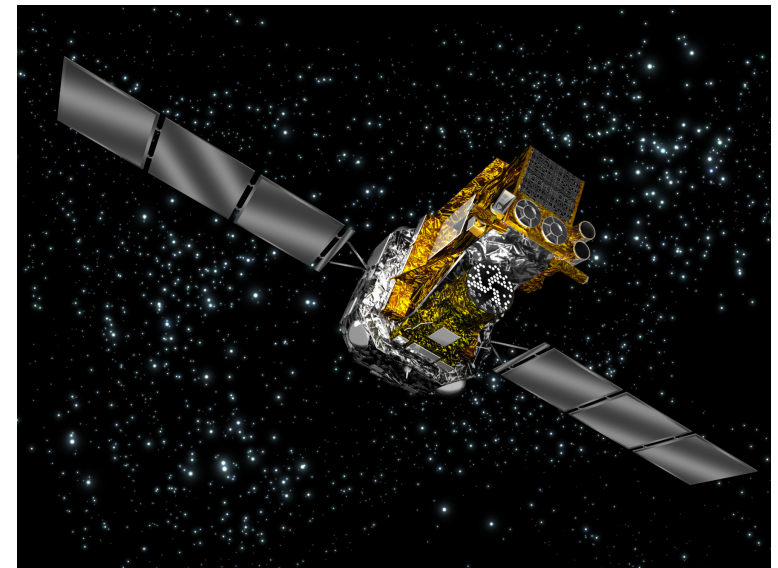




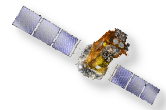
INTEGRAL

Project Scientist Report

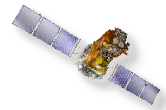
Erik Kuulkers
(ESA/ESTEC)



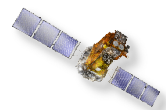
IUG Meeting #21 – ESTEC – 7 & 8 November 2018



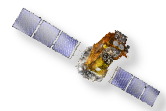
Community interfaces



Observatory status



Science highlights



Outreach



- Not attending (i.e., absence notified): Diego Götz, Norbert Schartel, Rashid Sunyaev
 - remotely (partly) Brad Cenko / Julie McEnery
- IUG Invitees: Guillaume Bélanger (secretary/minuteer), Richard Southworth (ESA/ESOC, INTEGRAL MOC), Elisabeth Jourdain (IRAP/CNRS)
- New IUG member & chair (since July 2018) – Lorraine Hanlon (UCD, Ireland)
- 19 June: lost Giorgio Palumbo – INTEGRAL Mission Scientist 1995–2014



NEW



Updates since last meeting (1)

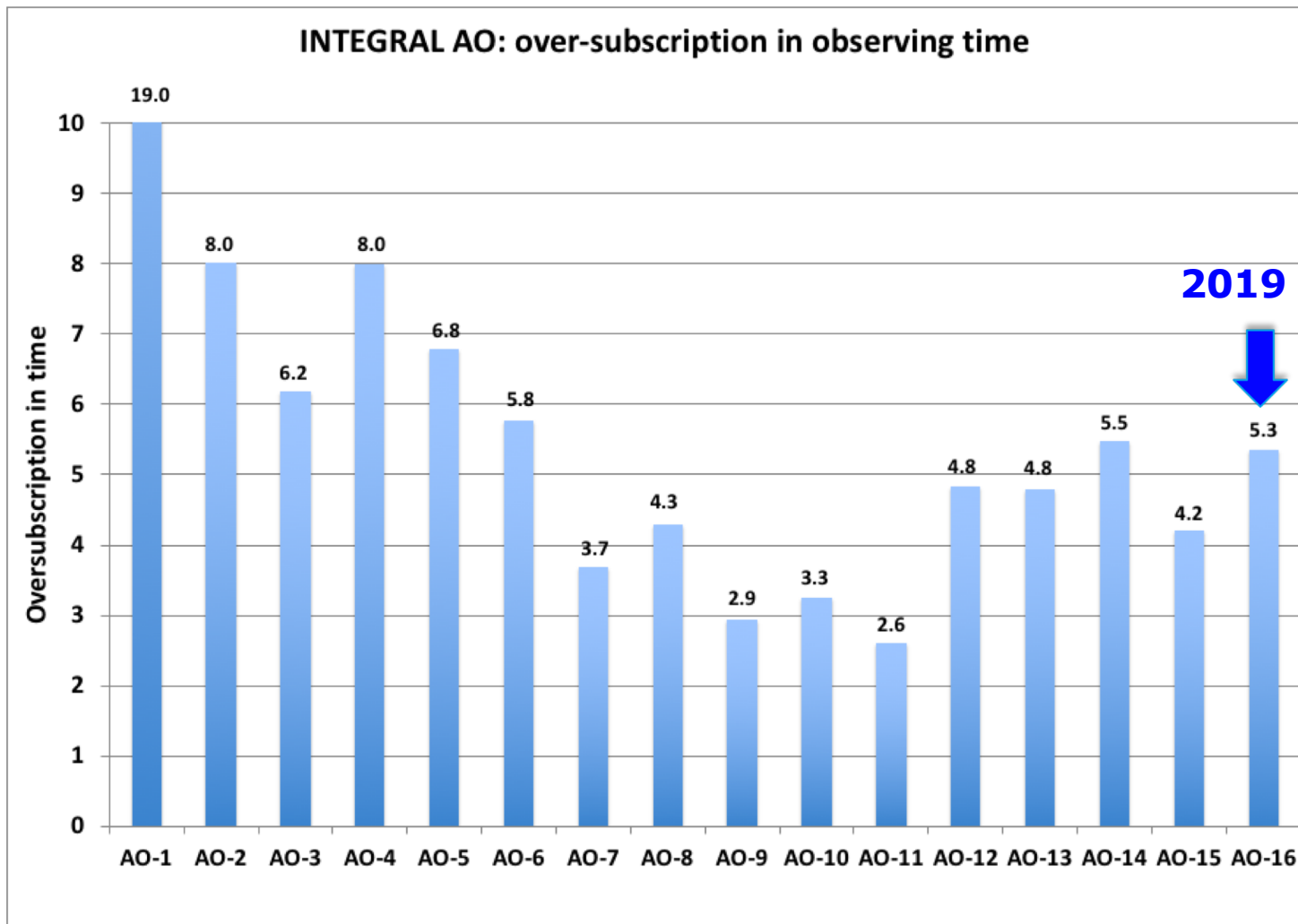
➤ Apr/May 2018: AO-16 [AO-15] call: 62 [65] proposals received (29 [33] normal, data rights on 422 [341] sources & 33 [32] ToO)

Scientific Category	Number of proposals
Galactic Astronomy	32
Extragalactic Astronomy	18
Nucleosynthesis and diffuse continuum/line emission	12
Total	62

➤ 21 Ms available → oversubscription 5.3 [4.2] - **see Next slide**

➤ TAC accepted 46 [54] proposals (20 [22] ToO) and granted 360 ks [140 ks] of XMM-Newton time, 144 ks [158 ks] of Swift time and 45 ks [70 ks] of NuSTAR time to, respectively, 6 [3] , 5 [7] and 2 [4] INTEGRAL proposals.

[INTEGRAL] Community interfaces

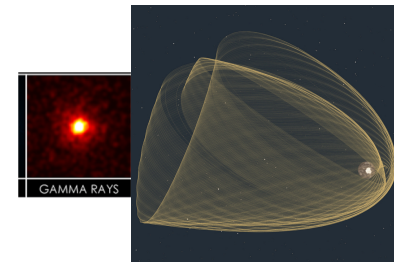


👉 2019: INTEGRAL serves >300 unique PI's+co-I's

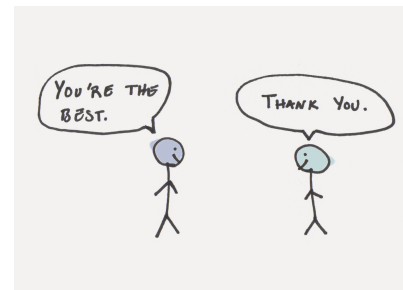


Updates since last meeting (2)

- 20/21 March: SPC approved indicative extension of INTEGRAL operations for 2020
- 5 June: Mission Extensions Operations Review (MEOR) spacecraft, payload and Ground Segment in good condition + able to deliver expected science return for 2019–2022
- 15–17 September: INTEGRAL's 2000th revolution around the Earth
- 10/11 October: AWG/SSWG: extension case presentation LH&EK
 - recommended operations of INTEGRAL for 2019-2020
 - recommended extending operations of INTEGRAL for 2021-2022
- 15/16 October: SSAC:
 - confirmed previous recommendations to extend INTEGRAL
 - extension of operations of INTEGRAL in 2021-2022 fully scientifically justified



→ Thank you for your inputs to science case!





Updates since last meeting (3)

- 17 October: 16 years of INTEGRAL operations
- 19 October: release of analysis software, OSA, version 11.0

Near future (1)

- 20/21 November: SPC meeting

SPC will be invited to:

- Approve INTEGRAL operations for 2019/2020
 - Indicative approval of extending INTEGRAL operations into 2021/2022
- 11–14 February 2019: 12th INTEGRAL Conference and 1st AHEAD Gamma-ray workshop
'INTEGRAL looks AHEAD to Multi-Messenger Astrophysics'
Geneva, Switzerland
 - don't forget deadline for talk abstracts is 20 November
registration + poster abstract deadline is 4 January 2019
 - When do 13th INTEGRAL conference? What about interim ("Italian") workshop?
 - What about small workshop focused on specific INTEGRAL science topic (e.g., black holes, GC)?
 - O3 (GWs) starts in February 2019



Near future (2)

➤ AO-17 Observing Time proposals:

- Release of AO-17: call for proposals: **TBD 2019**
- Deadline for submission of proposals: **TBD 2019 (14:00 CEST)**
- Meeting of the TAC: **13-15 May 2019**
- Start of AO-17 cycle of observations: **1 January 2020**

➤ AO-17 Coordination:

- **TBC:** XMM-Newton (300 ksec), Swift (150 ksec) & NuSTAR (100 ksec) [& Fermi through their AO]
- To be notified: INTEGRAL users, HEAD, Swift/NuSTAR community
- To be notified: Chinese/Indian/Japanese high-E community
- More ideas to foster cooperation & INTEGRAL awareness?!

➤ AO-17 TAC:

- New TAC members: suggestions?
- 2 or 3 panels?
- How to distribute TAC panel time? → GB



Community interfaces



Observatory status



Science highlights



Outreach



Update since last meeting

- SPI annealing: #31 (21/7-6/8 2018) – recovery, while not perfect, is satisfactory ($\Delta E/E \sim 0.2\%$ @ 1764 keV)
- Cross-calibration/coordinated observations (INTEGRAL mostly public):
 - i. 16 March – 10 May 2018: ToO on MAXI J1820+070 (BHC transient): multi- λ including XMM-Newton, NICER, NuSTAR & Swift; data public + ready-to-use light curve products at ISDC (JEM-X: 3–25 keV & IBIS/ISGRI: 25–60 and 60–200 keV) total 1.4 Msec \sim 16 days of exposure
 - ii. 13–14 April: Crab, coordinated with Astrosat, Insight-HXMT, NICER, NuSTAR, Swift & XMM-Newton, as well as radio & optical
 - iii. 4–5 July: 3C273, coordinated with Astrosat, Chandra, HXMT, INTEGRAL, NICER, NuSTAR, Swift & XMM-Newton
 - iv. 13 September: Crab, coordinated with NICER, NuSTAR & XMM-Newton + others
→ *cross-calibration results?*
- 2 GRBs in FOV: GRB180222A, GRB180714A





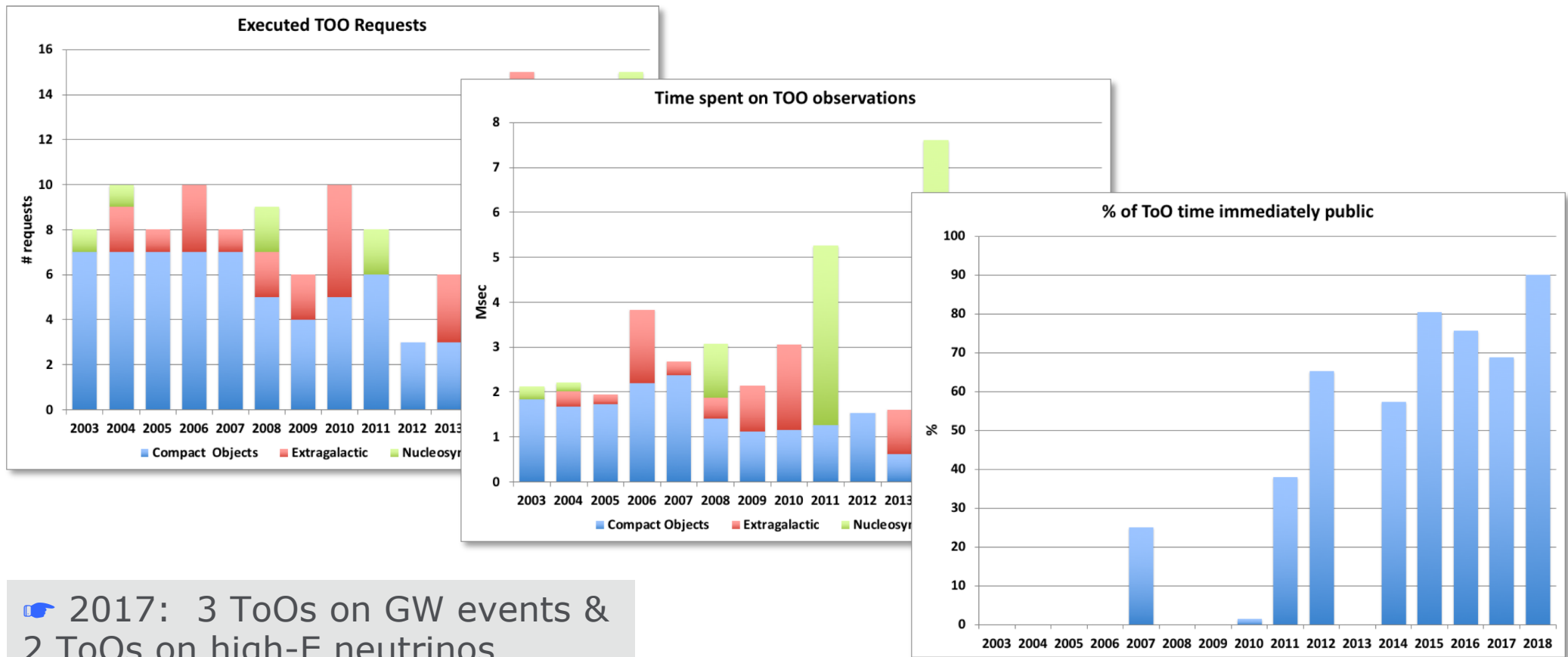
Update since last meeting (continued)

- Gaia/XMM-Newton/INTEGRAL Spacon merger 11 April
 - No significant impact for INTEGRAL
- Currently: minimal reaction times of 5–8 hours between trigger and observation have been achieved for ToO follow-up observations
 - SOC & MOC are investigating possibility of quick intervention of the planning schedule to do a *very rapid* ToO follow-up observation **within a few hours** of the trigger of an important event (such as GW170817), to search for any 'afterglow' emission
 - If operational, this would be done only in *exceptional, favourable, situations* as a *best effort* activity, *without risk* to spacecraft and payload

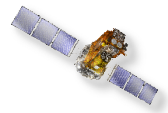
[INTEGRAL] Observatory status



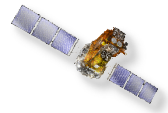
INTEGRAL ToOs (up to September 2018)



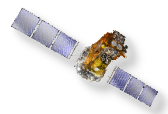
👉 2017: 3 ToOs on GW events & 2 ToOs on high-E neutrinos



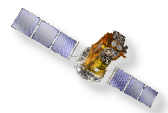
Observatory status



Community interfaces

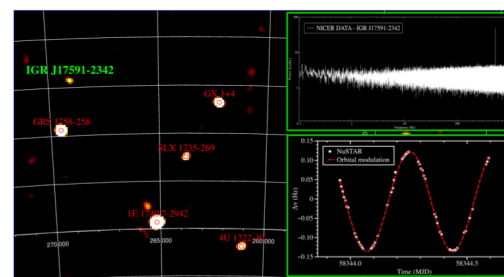
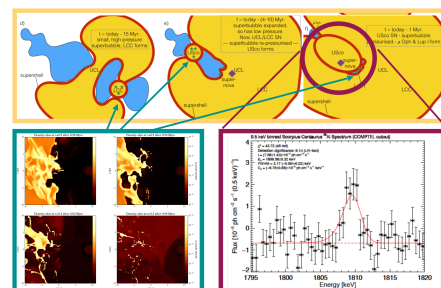
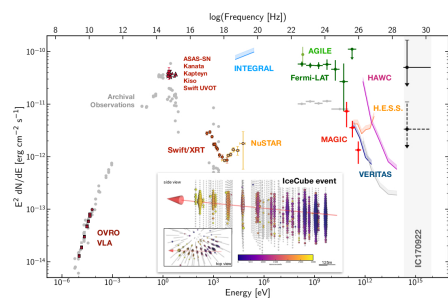
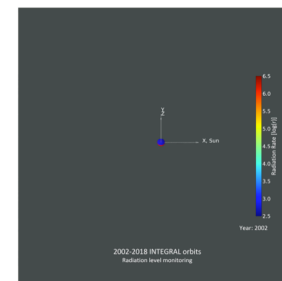
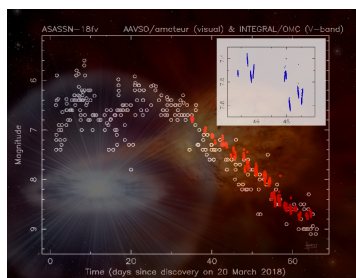
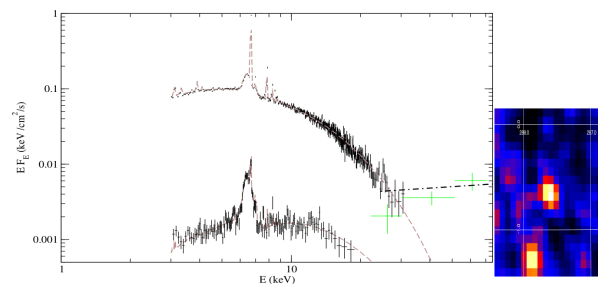
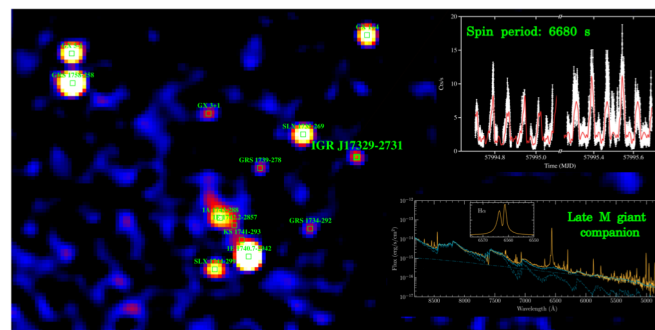
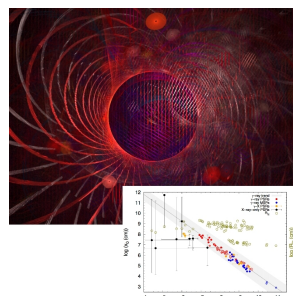
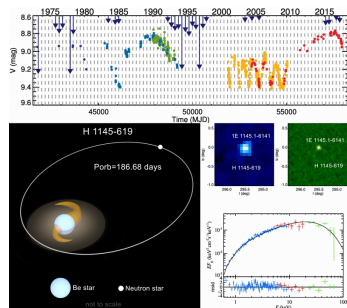


Science highlights



Outreach

[INTEGRAL] Science highlights (POM)



INTEGRAL LOOKS AHEAD TO MULTI-MESSENGER ASTROPHYSICS
 12th INTEGRAL Conference - 1st AHEAD Gamma-ray Workshop
 11-15 February 2019 - Campus Biotech, Geneva, Switzerland

Invited Speakers
 Monica Bruehler, Chris Fryer, Keith Galloway, Michael Goussard, Karl Kravitz, Gaudard Lohr, Armin Muehle, Peter Rezzonelli, Alessandra Rappini, Frank Pöschel, Luigi Piro, Gennadiy Vasiliev, Gennadiy Vasiliev, Thomas Sargant (and more to be confirmed...)

Scientific Organising Committee
 Walter Burkert, Emma Bates, Tony Bell, Marco Buitrago, Roger Chant, David Cohen, Robert Drell, Carlo Ferraro (chair), Diego Gal, Vladimir Gehrmann, Giacomo Giacconi, Lorenzo Herten, Dieter Herten, Alexander Kienke, Stefan Kienke, Gert Köhler (co-chair), Philippe Lacombe, Alexander Lohr, Armin Muehle, John McEvoy, John Mowbray, Lorenzo Natalucci, Stefano Orsi, Alessandra Rappini, Luca Piro, Luigi Piro, Peter Rezzonelli, Ben de Soto, Vincent Tatischeff, John Warwick, Hans-Walter Wink, Peter von Ballmoos (co-chair), Ben Willms

Local Organizing Committee
 Carlo Ferraro, Emma Bates, Vladimir Burkert, Marco Buitrago, Peter von Ballmoos

www.esa.int
 European Space Agency

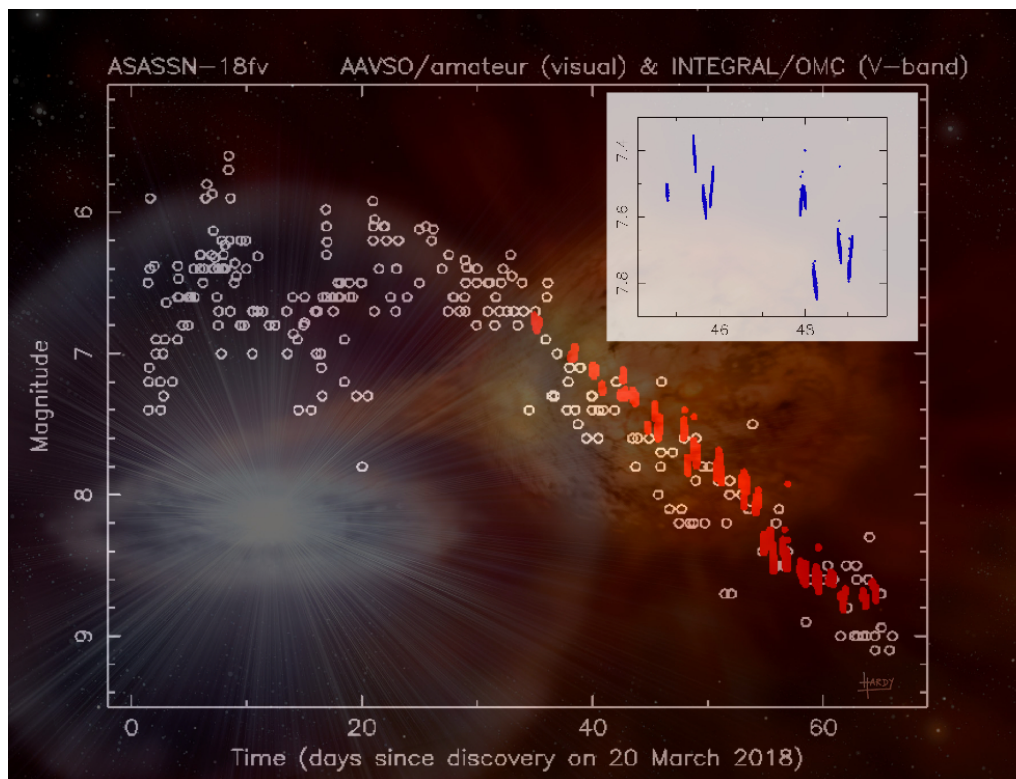
INTEGRAL POM: <http://www.cosmos.esa.int/web/integral/pom-archive>

[INTEGRAL] Science highlights



POM June
2018

ASASSN-18fv



Domingo et al. 2018, Atel #11677

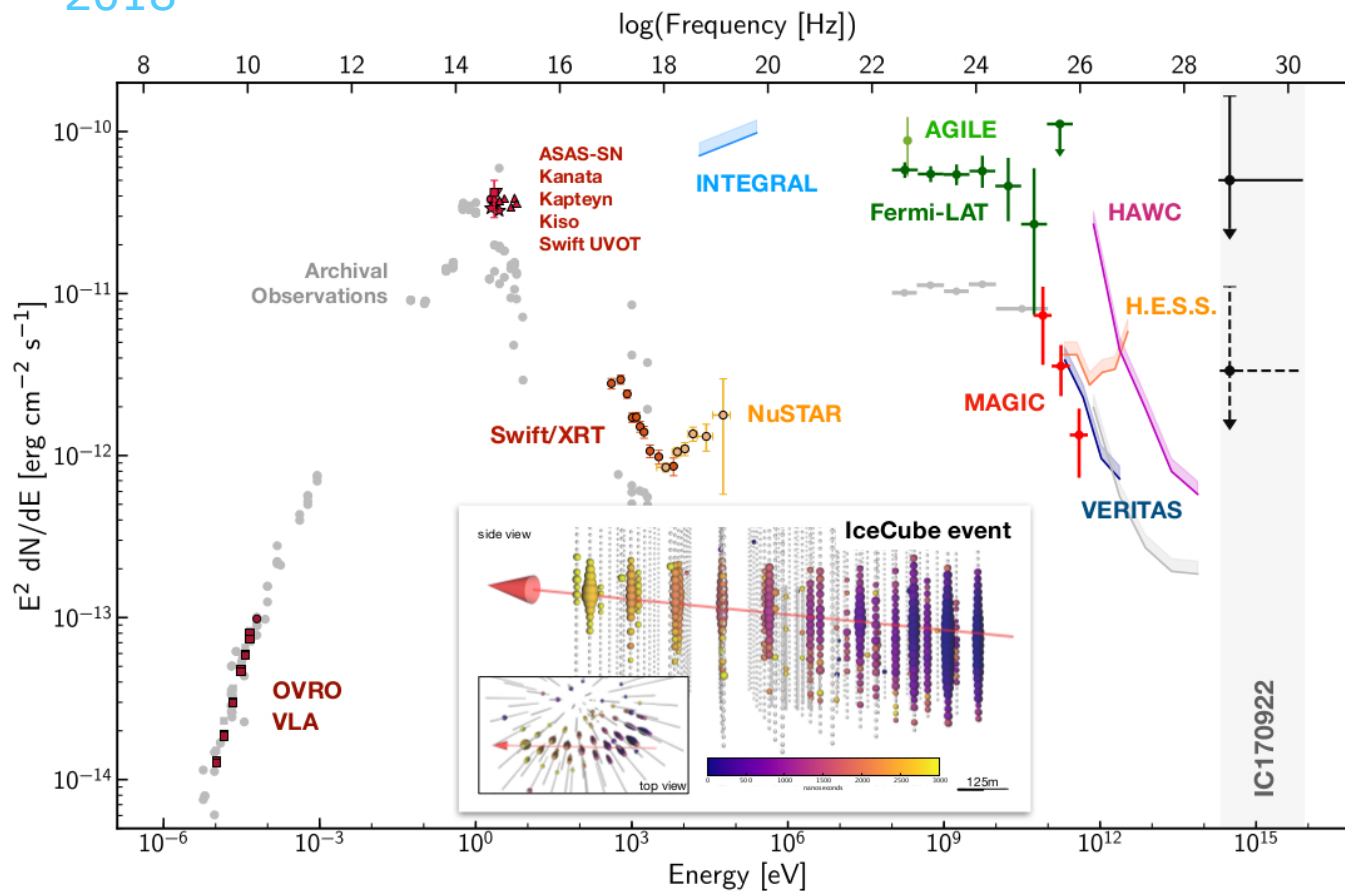
- 20 March: a new bright transient optical source with $\Delta V > 6$ mag. Peak $V > 6$ mag
- Early April: Fermi/LAT and AGILE emission > 100 MeV. Also NuSTAR.
- Possibly a nova
- 23 April – 11 June: INTEGRAL out-of-TAC ToO; OMC partly in fast mode
Aim: if classical nova, expect line emission: decay of ${}^7\text{Be}$ at 478 keV or of ${}^{22}\text{Na}$ at 1275 keV, depending on nova type. *None reported*
Total observing time: 2.8 Msec (~ 32 days)
- J-class nova (but not 100% clear)

[INTEGRAL] Science highlights



POM Aug
2018

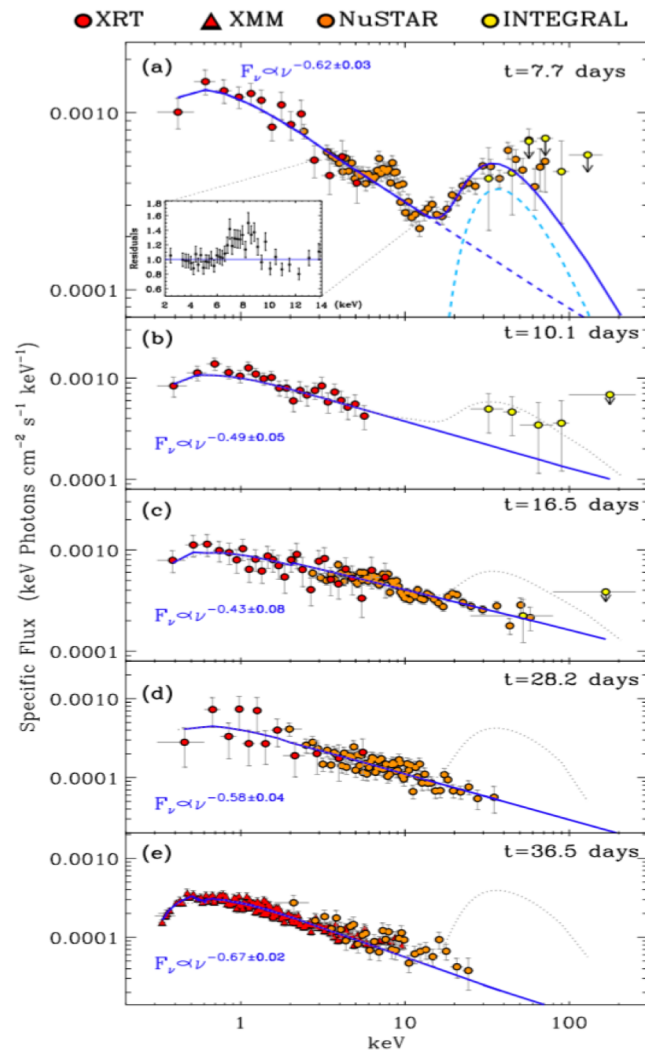
IceCube-170922A /TXS 0506+056



Domingo et al. 2018, Atel #11677

- 22 September 2017: IceCube-170922A
- Large multi-wavelength campaign
- INTEGRAL serendipitous observations (+ SPI/ACS) – no detection
→ upper limits, also on any temporal behavior
- 12 July - Global PR

[INTEGRAL] Science highlights



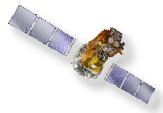
AT2018cow

- 16 June: ATLAS survey: new kind of transient; fast-rising blue optical transient (FBOT)
- rose over a few days to a peak luminosity $L_{\text{pk}} \sim 4 \times 10^{44} \text{ erg s}^{-1}$ exceeding those of superluminous supernovae (SNe)
- 22 June – 8 July: INTEGRAL out-of-TAC ToO
Total observing time: 900 ksec (~ 10.5 days)
- NuSTAR+INTEGRAL: new *temporal* spectral component of hard X-ray emission at $E \geq 10 \text{ keV}$ — reminiscent of “Compton humps” and Fe K-shell emission observed in AGNs and XRBs
→ would have been entirely missed in the absence of NuSTAR/INTEGRAL observations.

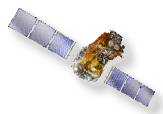
Margutti et al. 2018, ApJ submitted



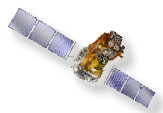
Observatory status



Community interfaces

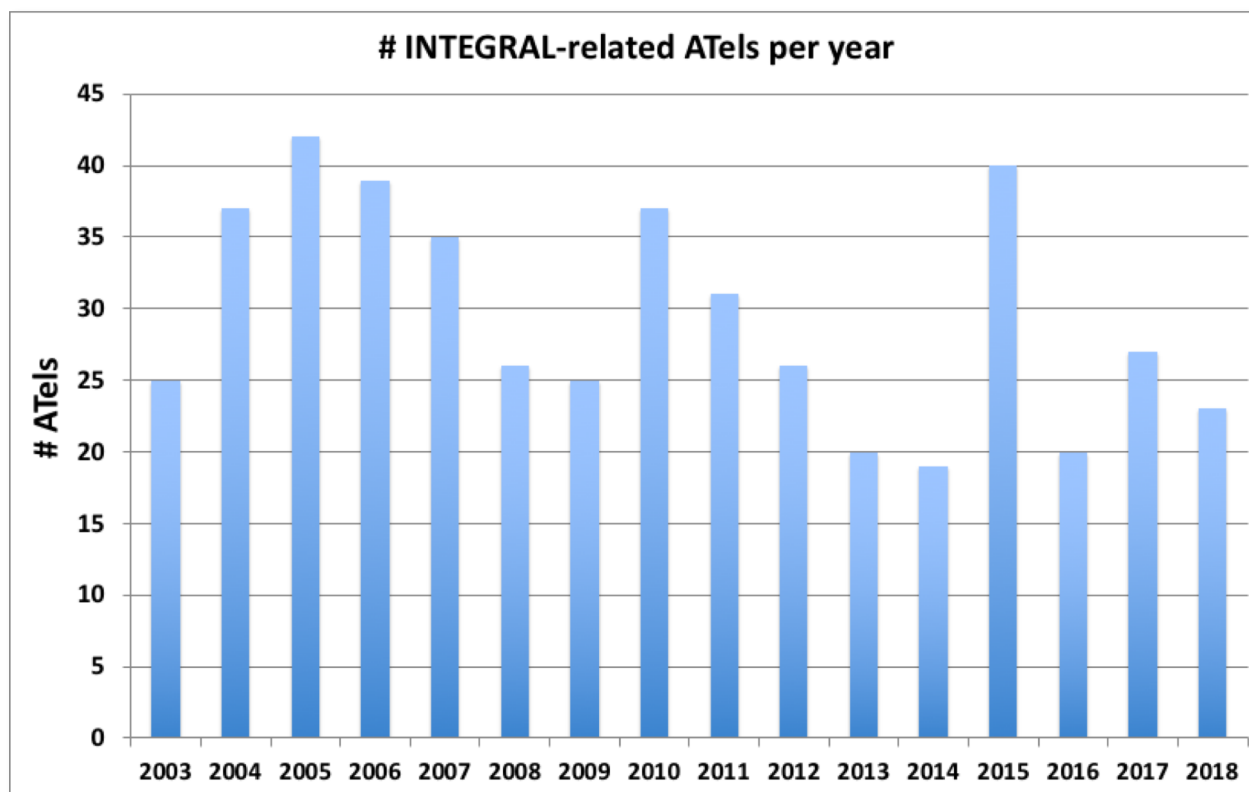


Science highlights



Outreach

Quick notifications of discoveries/follow-ups

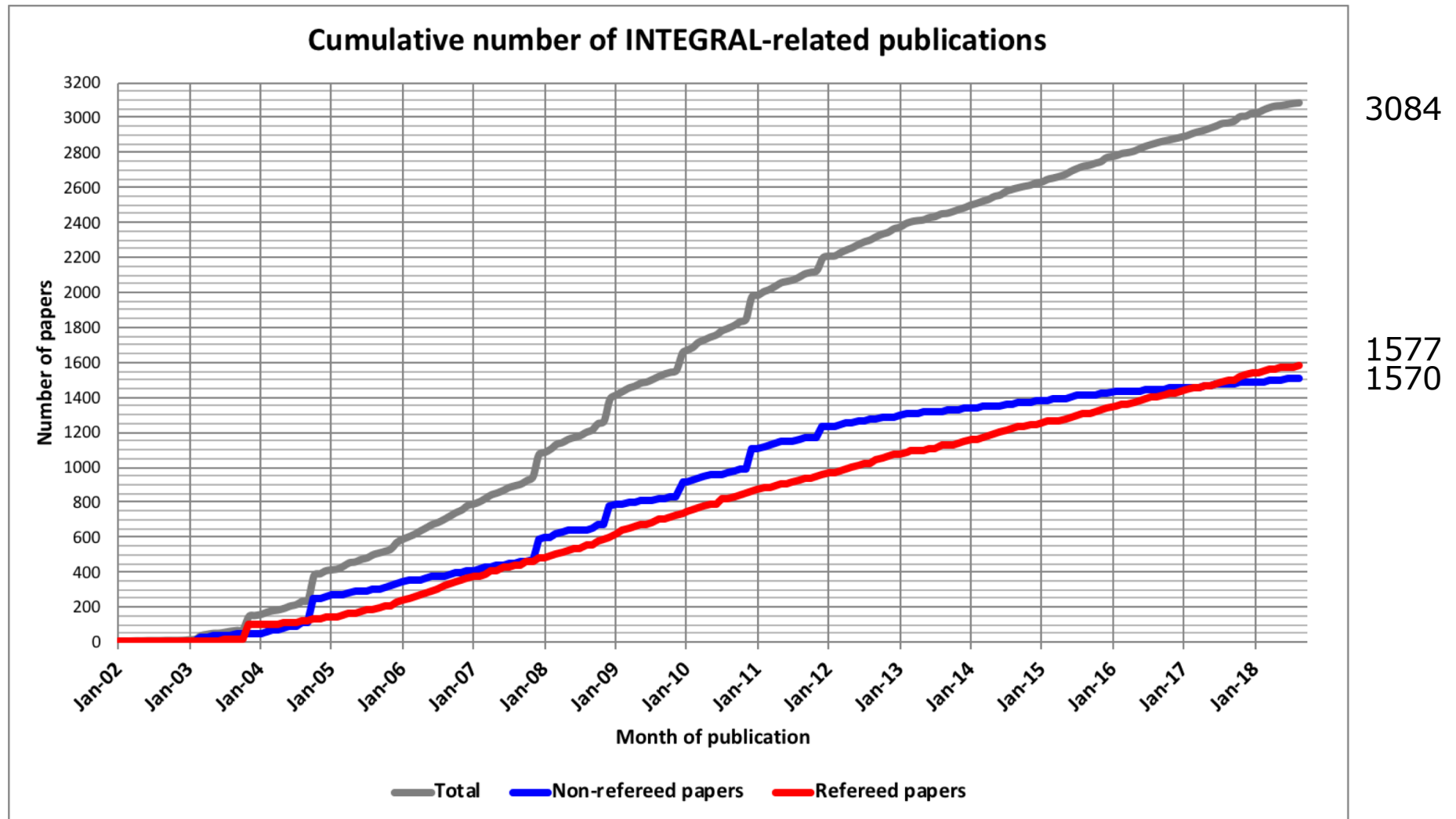


(as of September 2018)

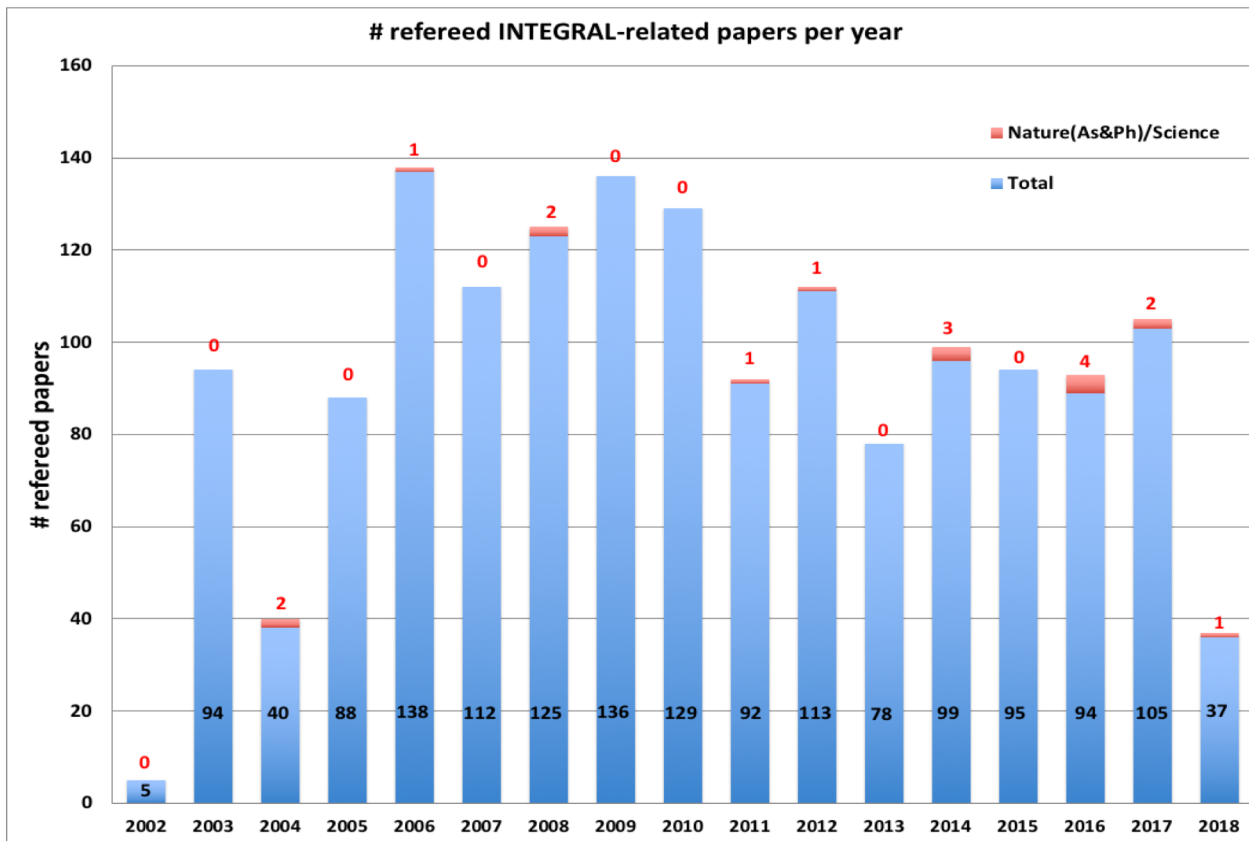
👉 2015:
25% on V404 Cygni



Refereed publication statistics (up to September 2018)



Refereed papers statistics



Total since launch,
up to Sep 2018:
1577 refereed

👉 2015-2018:
30 papers using V404 Cyg
immediately public ToO data



Status since last meeting (21+22 February 2018)

ESA's INTEGRAL-related PR web-stories	
Donor star breathes life into zombie companion	5 March 2018
INTEGRAL joins multi-messenger campaign to study high-energy neutrino source	12 July 2018

stories in:

2018	-	2	+ Twitter!
2017	-	5 (3 GW)	+ Twitter!
2016	-	3	+ Twitter!
2015	-	3	+ Twitter!
2014	-	1	

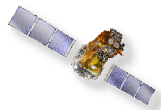


As always...: suggestions and proposals for new outreach products welcome!
(not only Nature or Science papers...)



INTEGRAL review – New Astronomy Reviews (lead by Ed) – status?

[INTEGRAL]



Miscellaneous



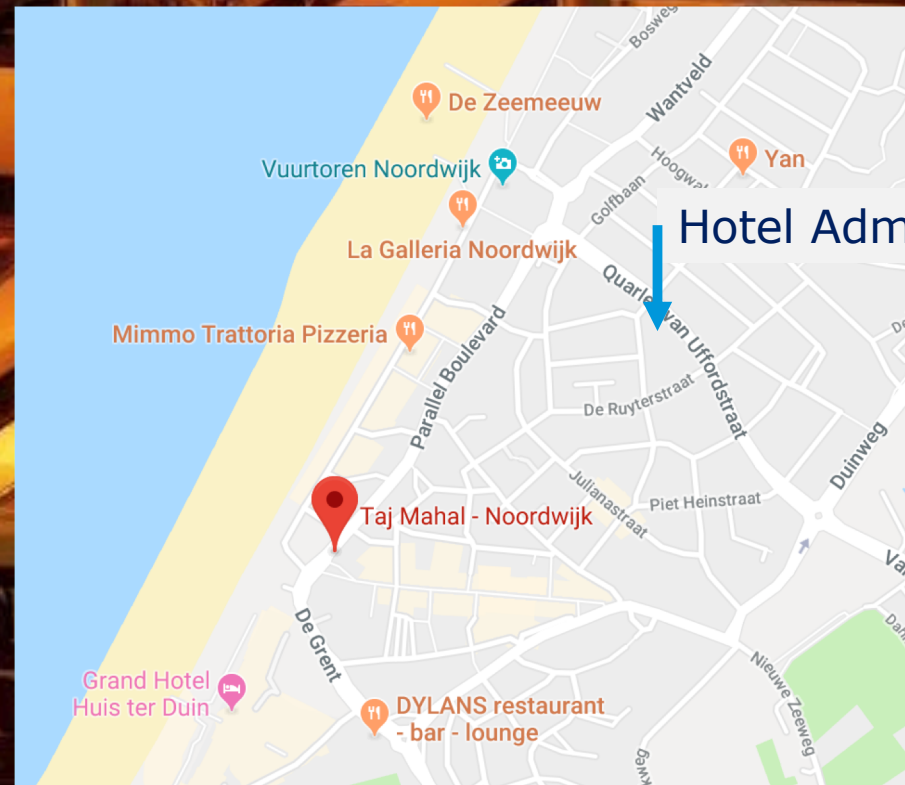
Issues/questions/to be solved and or status

- INTEGRAL inter-calibration status? – PI's
- High-E cross-calibration status? – PI's, IACHEC?
→ *IACHEC report by Elisabeth Jourdain*
- OSA11 – feedback? – ISDC
- > OSA11? e.g., PICsIT, polarization S/W – ISDC, PI's
→ *E-mail from L. Sidoli & A. Paizis*
- Legacy Archive – ISOC, ISDC, PI's
- list of INTEGRAL-related PhD theses has been updated
- TBF (to-be-finished): list of prizes/grants
- ... any more?

[INTEGRAL] Dinner tonight



Indian Restaurant - Taj Mahal
Parallel Boulevard 2A, Noordwijk



@19:00 - Who's joining?

[INTEGRAL]



That's it for now