TOMASO, DIPS, CYGNUS X-1

MY PERSONAL RECOLLECTION, KIND OF CHRONOLOGICALLY…

Erik Kuulkers, ESA/ESTEC, The Netherlands

ERIK KUULKERS

TOMASO, DIPS, CYGNUS X-1

22 years ago… good to be back!

Interacting Binaries: Accretion, Evolution, and Outcomes

4–10 July 2004 – Cefalù, Sicily, Italy

65–3 years ago…

Dr. Tomaso M. Belloni (†)

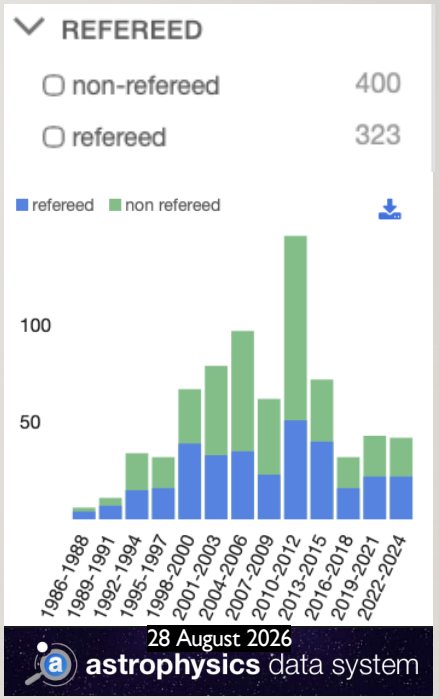
1961–2023

Short Curriculum Vitae

- **1986–1987:** IFCTR, Milan, Italy — software development & EXOSAT/IUE analysis
- **1988–1994:** Max-Planck-Institut für extraterrestrische Physik (MPE), Garching, Germany — fellowship, working in the ROSAT group
- **1994–1996: Marie Curie Fellow**, Astronomical Institute "Anton Pannekoek", University of Amsterdam, The Netherlands
- **1996–1999: Postdoc**, Astronomical Institute "Anton Pannekoek", University of Amsterdam, The Netherlands
- **1999 onward:** Osservatorio Astronomico di Brera, Merate, Italy

1994–1999: Associated with Michiel van der Klis's high-energy astrophysics group

Tomaso is active…



ERIK KUULKERS

TOMASO, DIPS, CYGNUS X-1

27–24 years ago…

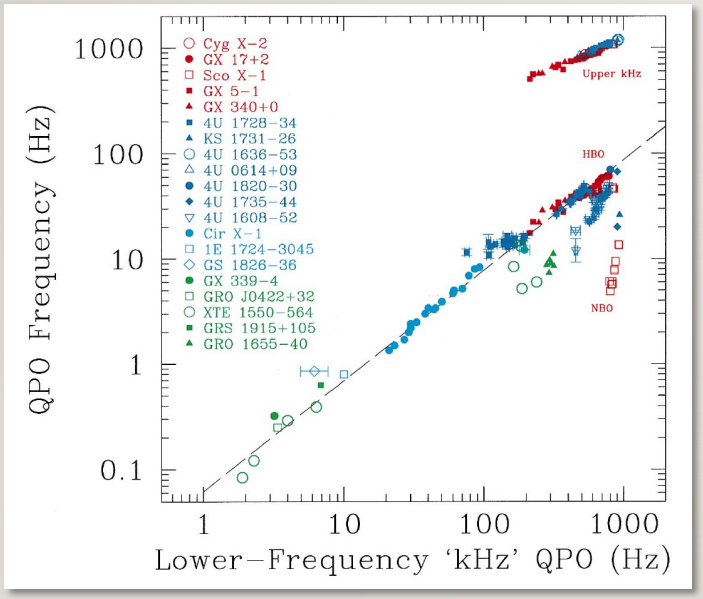
QPO, QPO, QPO … and noise …

20 July 1999 & 10 June 2002 – ApJ 520, 262 & ApJ 572, 392

THE ASTROPHYSICAL JOURNAL, 520:262–270, 1999 July 20

CORRELATIONS IN QUASI-PERIODIC OSCILLATION AND NOISE FREQUENCIES AMONG NEUTRON STAR AND BLACK HOLE X-RAY BINARIES

DIMITRIOS PSALTIS
Harvard-Smithsonian Center for Astrophysics, 60 Garden Street, Cambridge, MA 02138; dpsaltis@cfa.harvard.edu
AND
TOMASO BELLONI AND MICHIEL VAN DER KLIS
Astronomical Institute "Anton Pannekoek," University of Amsterdam; and Center for High Energy Astrophysics, Kruislaan 403, NL-1098 SJ, Amsterdam, The Netherlands; tmb@astro.uva.nl, michiel@astro.uva.nl
Received 1998 September 22; accepted 1999 February 24



Tomaso likes to identify things…

THE ASTROPHYSICAL JOURNAL, 572:392–406, 2002 June 10

A UNIFIED DESCRIPTION OF THE TIMING FEATURES OF ACCRETING X-RAY BINARIES

TOMASO BELLONI
Osservatorio Astronomico di Brera, Via E. Bianchi 46, I-23807 Merate (LC), Italy; belloni@merate.mi.astro.it
DIMITRIOS PSALTIS
School of Natural Sciences, Institute for Advanced Study, Princeton, NJ 08540; dpsaltis@ias.edu
AND
MICHIEL VAN DER KLIS
Astronomical Institute "Anton Pannekoek," University of Amsterdam, and Center for High-Energy Astrophysics, Kruislaan 403, NL 1098 SJ Amsterdam, Netherlands; michiel@astro.uva.nl
Received 2000 May 22; accepted 2002 February 18

Empirical model for unified description of power spectra of accreting neutron stars and black holes.
Description is based on superposition of multiple Lorentzians and offers advantage that all QPO and noise components are dealt with in same way, without need of deciding in advance the nature of each component…

Start of mission	
Launch date	30 December 1995, 13:48:00 UTC
Entered service	30 December 1995
End of mission	
Deactivated	12 January 2012

- All-Sky Monitor (ASM), 2–12 keV
- Proportional Counter Array (PCA), 2–60 keV, max 6,500 cm^2
- High Energy X-ray Timing Experiment (HEXTE), 15–250 keV

Correlations between frequencies of QPO and noise components in low-mass X-ray binaries, including neutron star sources and black hole candidates

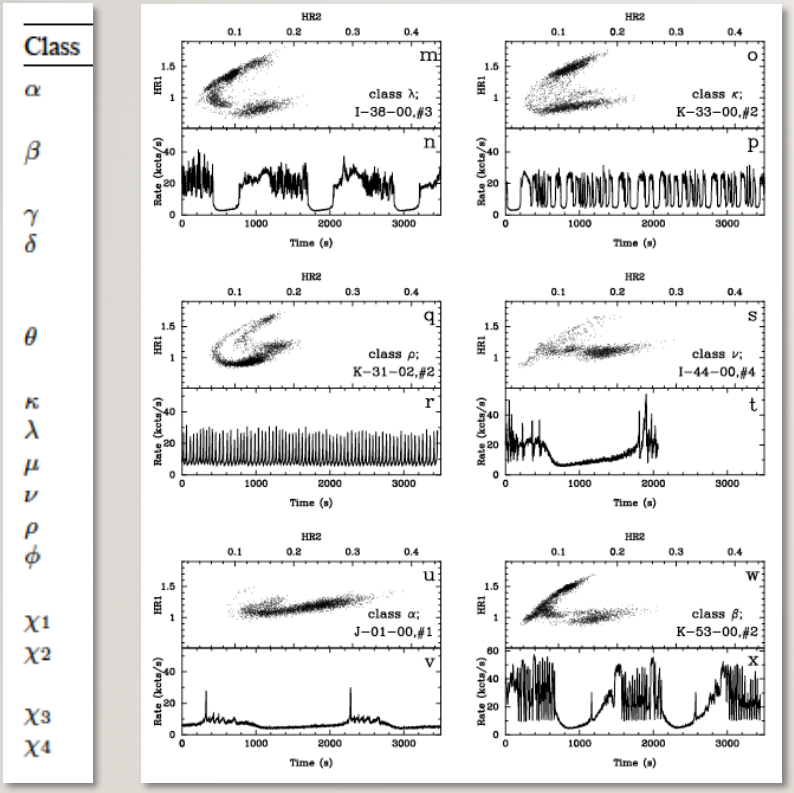
ERIK KUULKERS

TOMASO, DIPS, CYGNUS X-1

26 years ago…

crazy GRS 1915+105 …

March 2000 – A&A 355, 271



Tomaso likes to classify things…

Astron. Astrophys. 355, 271–290 (2000)

ASTRONOMY AND ASTROPHYSICS

A model-independent analysis of the variability of GRS 1915+105

T. Belloni[1,2], M. Klein-Wolt[1], M. Méndez[1,3], M. van der Klis[1], and J. van Paradijs[1,4]

[1] Astronomical Institute "Anton Pannekoek", University of Amsterdam and Center for High-Energy Astrophysics, Kruislaan 403, 1098 SJ Amsterdam, The Netherlands
[2] Osservatorio Astronomico di Brera, Via E. Bianchi 46, 23807 Merate (LC), Italy
[3] Facultad de Ciencias Astronómicas y Geofísicas, Universidad Nacional de La Plata, Paseo del Bosque S/N, 1900 La Plata, Argentina
[4] Physics Department, University of Alabama in Huntsville, Huntsville, AL 35899, USA

Received 25 October 1999 / Accepted 5 January 2000

Analysis of 163 observations of microquasar GRS 1915+105 made with RXTE/PCA in1996-1997

→ Classification into 12 separate classes, based on count rate and color characteristics

ERIK KUULKERS

TOMASO, DIPS, CYGNUS X-1

33 years ago…

NATO Advanced Study Institute workshop "The Lives of the Neutron Stars"

29 August –12 September 1993 – Kemer, Turkey

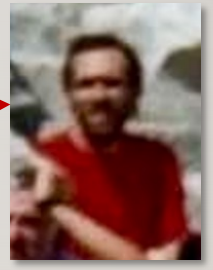
My first encounter with Tomaso…

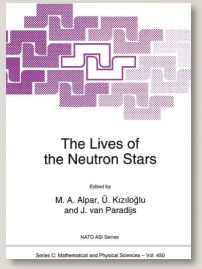
Road trip, Turkey – September 1993

Serik, Turkey – September 1993

Serik: a city in the province Antalya at the Turkish Rivièra

Ancient hillside theater – Phaselis Ancient City, Turkey – September 1993



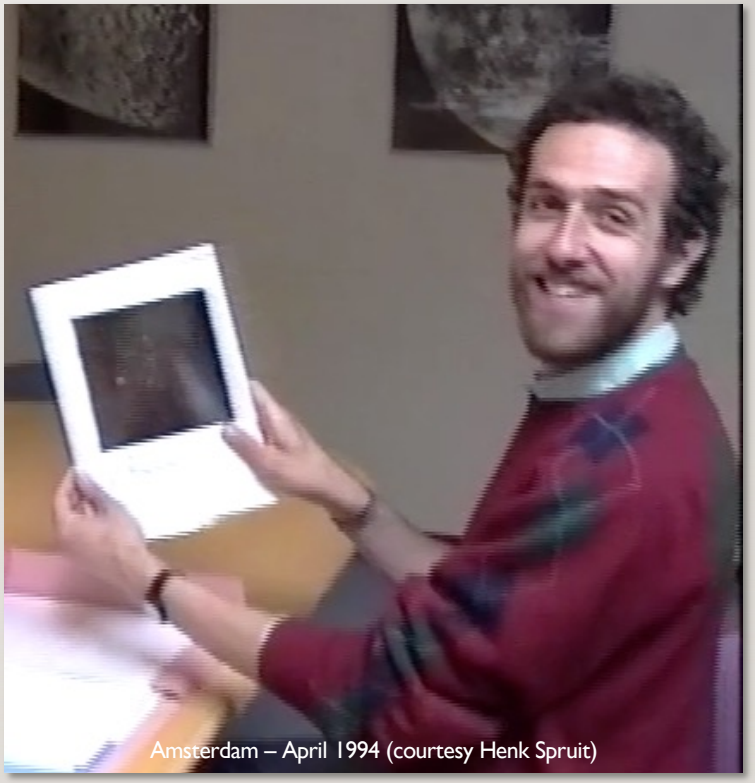


32–27 years ago…

Tomaso in core Van der Klis group

1994–1999 – "Anton Pannekoek" Institute (API) for Astronomy, Amsterdam

Person	Approx. Amsterdam period relevant here	Status / role
Michiel van der Klis	**throughout**	Professor; group leader
Jan van Paradijs	**throughout–1999**	Professor/senior staff
Tomaso Belloni	**1994–1999**	Marie Curie fellow → postdoc
Brian Vaughan	**1994–1995**	postdoc
Erik Kuulkers	**1994-1995**	PhD student
Rudy Wijnands	**1996–2000**	PhD student
Mariano Méndez	**1996–2001**	postdoc
Jeroen Homan	**1997–2002**	PhD student
Eric Ford	**1997–1999**	researcher/postdoc



Amsterdam – April 1994 (courtesy Henk Spruit)

TOMASO, DIPS, CYGNUS X-1

ERIK
KUULKERS

ERIK KUULKERS

TOMASO, DIPS, CYGNUS X-1

28 years ago…

Belloni & Kuulkers – dips

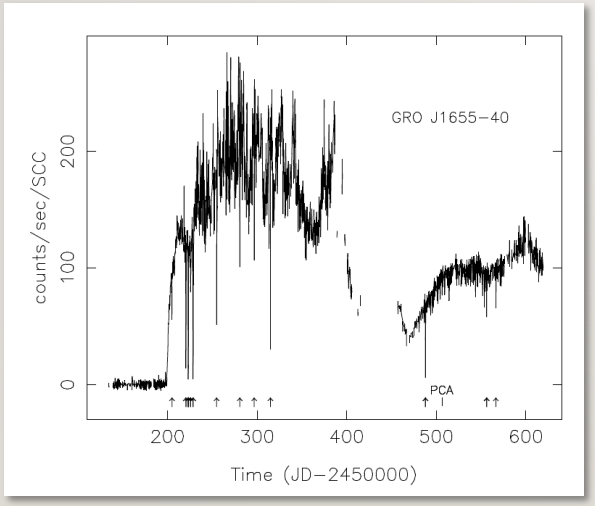
20 February 1998 – ApJ 494, 53

Our first dips…

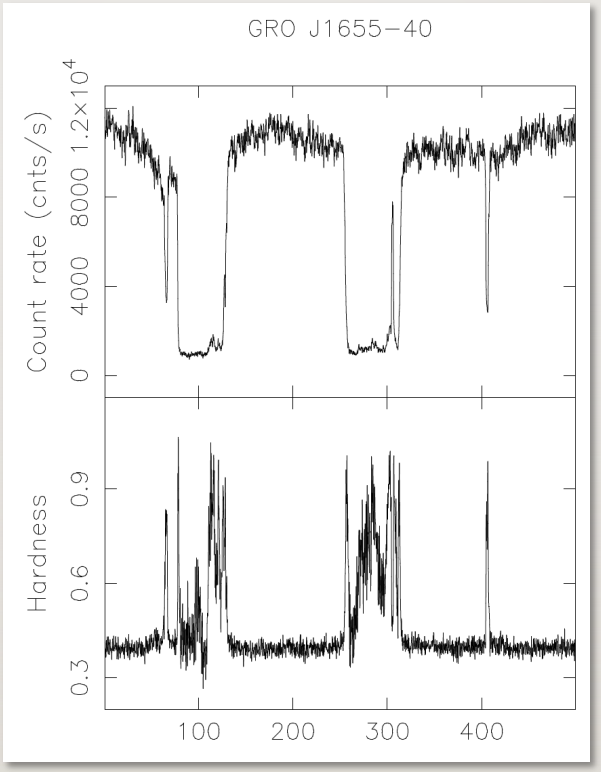
THE ASTROPHYSICAL JOURNAL, 494:753–758, 1998 February 20

ABSORPTION DIPS IN THE LIGHT CURVES OF GRO J1655–40 AND 4U 1630–47 DURING OUTBURST

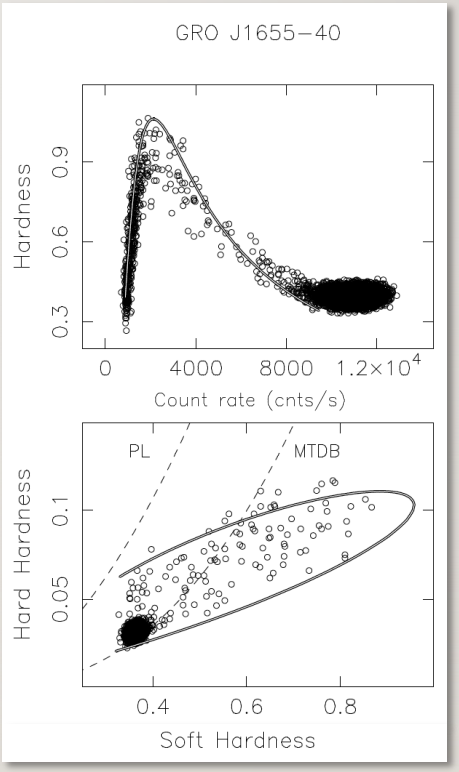
ERIK KUULKERS,[1] RUDY WIJNANDS,[2] TOMASO BELLONI,[2] MARIANO MÉNDEZ,[2,3] MICHIEL VAN DER KLIS,[2] AND JAN VAN PARADIJS[2,4]
Received 1997 August 11; accepted 1997 September 29



RXTE/ASM – ApJ, 20 Februaty 1998



RXTE/PCA – ApJ, 20 Februaty 1998



RXTE/PCA – ApJ, 20 February 1998

ERIK KUULKERS

TOMASO, DIPS, CYGNUS X-1

29–13 years ago…

Belloni & Kuulkers – dips (continued)

April 1997–April 2013 – Scientific output

1 ☐ 2013A&A...552A..32K 2013/04 cited: 95

MAXI J1659-152: the shortest orbital period black-hole transient in outburst

Kuulkers, E.; Kouveliotou, C.; Belloni, T. *and 12 more* P_{orb}= 2.414 ± 0.005 hours

2 ☐ 2012ATel.4073....1K 2012/04 cited: 2

On the absorption dips in MAXI J1305-704

Kuulkers, E.; Motta, S.; Belloni, T. M.

3 ☐ 2010ATel.2926....1B 2010/10 cited: 11

RXTE dips yield better orbital period determination for MAXI J1659-152

Belloni, T. M.; Muñoz-Darias, T.; Kuulkers, E.

4 ☐ 2000ApJ...538..307D 2000/07 cited: 39

The Timing Evolution of 4U 1630-47 during Its 1998 Outburst

Dieters, S. W.; Belloni, T.; Kuulkers, E. *and 9 more*

5 ☐ 1999NuPhS..69..324K 1999/01

Absorption dips in GRO J1655-40: mapping the inner accretion disk

Kuulkers, E.; Wijnands, R.; Belloni, T. *and 3 more*

6 ☐ 1998ApJ...494..753K 1998/02 cited: 111

Absorption Dips in the Light Curves of GRO J1655-40 and 4U 1630-47 during Outburst

Kuulkers, Erik; Wijnands, Rudy; Belloni, Tomaso *and 3 more*

7 ☐ 1997IAUC.6637....2K 1997/04 cited: 2

GRO J1655-40

Kuulkers, E.; Belloni, T.; Mendez, M. *and 3 more*

1 September 2026 astrophysics data system

And only dips…

Tomaso M. Belloni
tomaso.belloni@brera.inaf.it
15 April 2012

To Erik
15/04/2012, 20:55

Fwd: ATel 4044. ***Instant Email Notice***: Transients

Dip dip! Shall we disprove the orbital period? They are stealing our world record!
T

Begin forwarded message:

From: atel@astronomerstelegram.org
Subject: ATel 4044. ***Instant Email Notice***: Transients
Date: April 15, 2012 19:05:51 GMT+01:00
To: tomaso.belloni@brera.inaf.it

Instant Email Notice: Transients

The Astronomer's Telegram http://www.astronomerstelegram.org

ATEL #4044 ATEL #4044

Title: MAXI J1305-704: Swift/XRT detection of dips, possible 1.5 hour period
Author: J. A. Kennea (PSU), Y. J. Yang, D. Altamirano (UvA), P. A. Evans (U Leicester), H. A. Krimm (CRESST/GSFC/USRA), P. Romano, V. Mangano (INAF-IASFPA), P. Curran (CEA-Saclay), K. Yamaoka (AGU) and H. Negoro (Nihon U.)
Queries: kennea@swift.psu.edu
Posted: 15 Apr 2012; 18:01 UT
Subjects:X-ray, Transient

We report on observations of MAXI J1305-704 (Sato et al., ATEL #4024) taken with the Swift X-ray Telescope (XRT). We have been performing regular short (1ks) observations of this object. During the observation beginning April 12th, 2012 at 17:53 UT we see a feature in the light-curve that appears to be a dip, similar to those seen in MAXI J1659-152 (e.g. Kennea et al., 2011, ApJ, 736, 22). This dip is accompanied by spectral hardening, likely due to increased photoelectric absorption during the dip.

dip dip!

MAXI J1305-704:
P_{orb}=0.394±0.004 days

Micela *et al.* 2024, A&A 684, A67

Tomaso M Belloni
belloni@merate.mi.astro.it
8 Februari 2006

To ekuulker@rssd.esa.int
08/02/2006, 18:02

Re: new Z source in 35 yrs?

Dips.. dips... where have I heard about dips before?
Tomaso

Tomaso Belloni Tel: +39-039-999-1170
INAF - Osservatorio Astronomico di Brera FAX: +39-039-999-1160
Via E. Bianchi 46 e-mail: belloni@merate.mi.astro.it
I-23807 Merate, Italy

On 8 Feb 2006, at 17:16, Erik Kuulkers wrote:

> By the way, the fact that it shows Cyg X-2 (and GX 5-1) like behaviour might mean that the source is viewed ad relatively high inclination. So other things to look out for are absorption dips in the light curves.

dips… dips…

54 years ago…

Belloni & Kuulkers – dips (continued)

3 May 1972 – The Muppets

Yip yip… it's all about identification

The Yip Yip Martians discover a telephone on Earth and try communicating with it using animals sounds...

ERIK KUULKERS

TOMASO, DIPS, CYGNUS X-1

26 years ago…

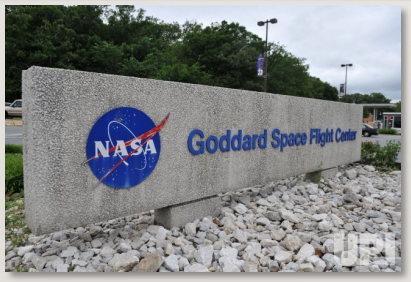
Rossi 2000: Astrophysics with the Rossi X-ray Timing Explorer
22–24 March 2000 – NASA/GSFC, Greenbelt, Maryland, USA

Tomaso's poster contribution

GRS 1915+105: Voyage into an Accretion Disk

T. Belloni (Brera Observatory, Merate, Italy)

RossiXTE has obtained a valuable and unique database of X-ray observations of the galactic microquasar GRS 1915+105. A surprising variety of variability is observed. I review the observations obtained in the first two years of the mission and show that they can be understood in terms of transitions between three basic states. I discuss the possible physical nature of these states and their relation to the "canonical" states of black hole candidates. With the help of detailed timing and spectral analysis, I show how the wealth of observations of these three states can help us to explore the physics of the accretion disk "from the inside".



Ron Remillard - † 28 July 2026…

"16 Years of Discovery with RXTE: A Celebration of the Mission"
Greenbelt, Maryland – March 2012 (courtesy Tod Strohmayer)

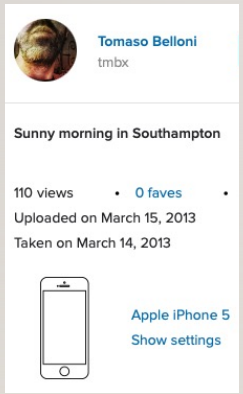
"PED XING" stands for pedestrian crossing, ofcourse…

26 years ago…

Tomaso behind the lens

4 March 2013–7 July 2023 – from Southampton to Puerto de la Cruz

"Sunny morning in Southampton"

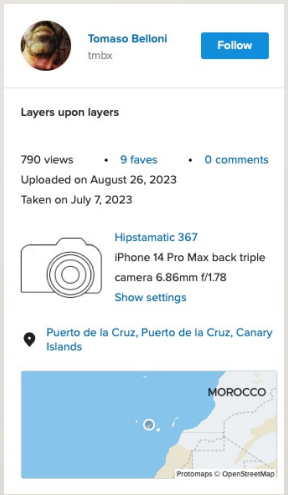


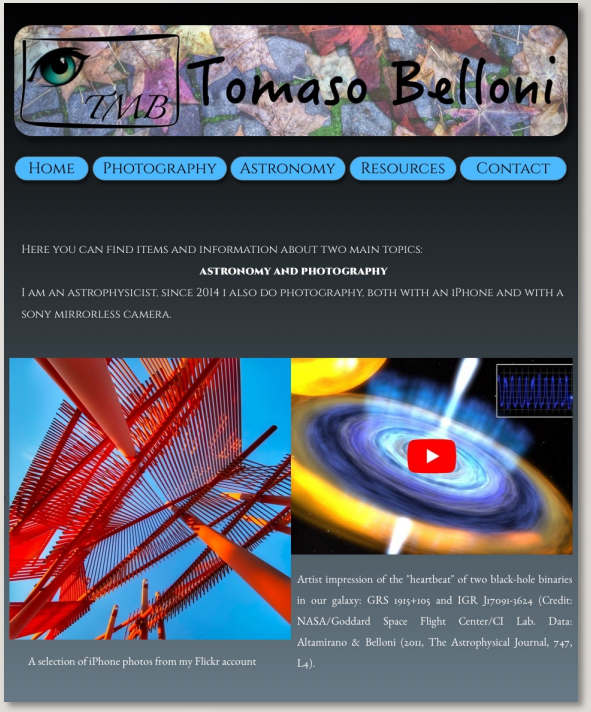
The first…

Tomaso's new hobby: iPhone & Sony mirrorless camera photography …

"Layers upon layers"

The last…





tomasobelloni.it

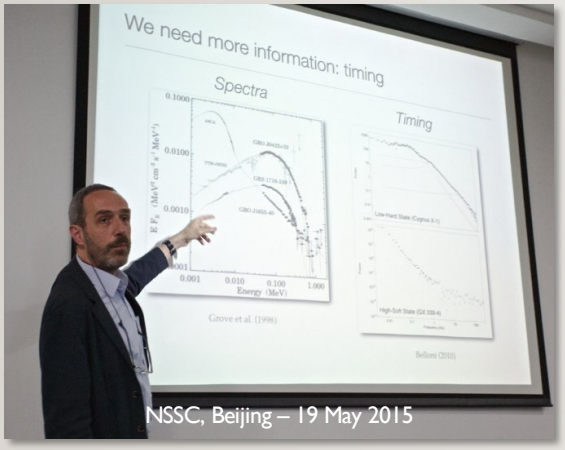
ERIK KUULKERS

TOMASO, DIPS, CYGNUS X-1

11 years ago…

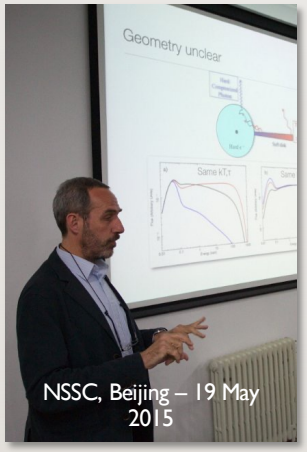
ISSI-Beijing Team 1st Meeting: Coronae in the X-ray Flashlight
11–15 May 2015 & 13-17 June 2016 – NSSC, Beijing, China

We need more information…



NSSC, Beijing – 19 May 2015

Geometry unclear…



NSSC, Beijing – 19 May 2015


NSSC, Beijing – 14 May 2015


NSSC, Beijing – 19 May 2015

Yet another meeting with Tomaso…

Attention state unclear…

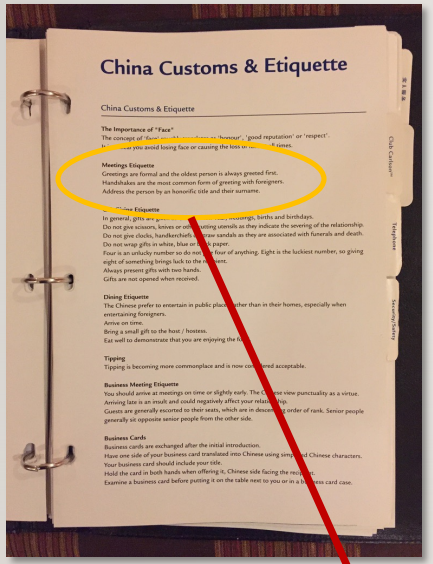

NSSC, Beijing – 12 May 2015

ERIK KUULKERS

TOMASO, DIPS, CYGNUS X-1

10 years ago…

ISSI-Beijing Team 2nd Meeting: Coronae in the X-ray Flashlight
13-17 June 2016 – NSSC, Beijing, China




NSSC, Beijing – 13 June 2015

ERIK KUULKERS

TOMASO, DIPS, CYGNUS X-1

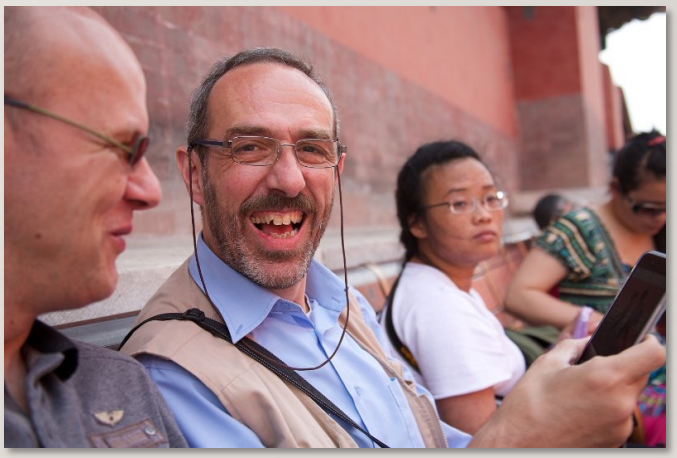
11 years ago…

Free time… photography!

7 May 2015 – Forbidden City, Beijing, China





Photos: Peter Kretschmar

11 years ago…

Free time… photography! (continued)

13 May 2015 – Summer Palace, Beijing, China

Photos: Peter Kretschmar

ERIK KUULKERS

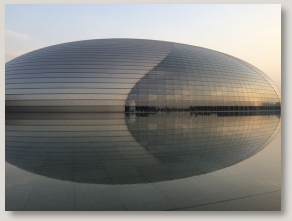
TOMASO, DIPS, CYGNUS X-1

26 years ago…

Fun time … culture!

May 2015, Beijing, China

National Centre for Performing Arts, Beijing – 13 May 2015



Beijing – 19 May 2015

Beijing – 10 May 2015

ERIK KUULKERS

TOMASO, DIPS, CYGNUS X-1

11&12 years ago…

INTEGRAL AO-13 & AO-14 Target Allocation Committee

26–28 May 2015 & 17–19 May 2016 – ESAC, Spain

ESA internal memos to Alvaro Giménez Cañete/D-SCI

Subject: INTEGRAL AO-13 observing programme selection

The purpose of this memo is to request your approval of the AO-13 observing programme as recommended by the INTEGRAL Time Allocation Committee (TAC).

The TAC has completed the review of AO-13 observing proposals and recommends again a scientifically exciting observing programme (attached below), which presents an excellent balance across scientific disciplines. The TAC met at ESAC from 26 to 28 May 2015.

Prof B. McBreen (University College Dublin) chaired the TAC, with three panels chaired by:

1. Tomaso Belloni, Italy,

The scientific research areas addressed by the three panels were respectively:

1. Galactic astronomy (point sources only, including stellar-mass collapsed objects, both binaries and isolated systems);
2. Extragalactic astronomy (point sources: AGN, Seyferts, Blazars; clusters of galaxies, cosmic diffuse background, and GRB);
3. Nucleosynthesis (including diffuse continuum and line emissions).

Subject: INTEGRAL AO-14 observing programme selection

The purpose of this memo is to request your approval of the AO-14 observing programme as recommended by the INTEGRAL Time Allocation Committee (TAC).

The TAC has completed the review of AO-14 observing proposals and recommends the observing programme attached below. The TAC met at ESAC from 17 to 19 May 2016.

Prof E. van den Heuvel (University of Amsterdam) chaired the TAC, with three panels chaired by:

1. Tomaso Belloni, Italy,

```
awk -F, '{ printf "Name: %s | Age: %s\n", $1, $2 }' users.csv
```

Tomaso does magic with awk…

The AWK Programming Language

The real magic of awk isn't syntax. It's speed.
The speed at which you can turn raw text into insight.
And in engineering, speed compounds.
Learn the tools that multiply your thinking —
not just the ones that look impressive on a résumé.

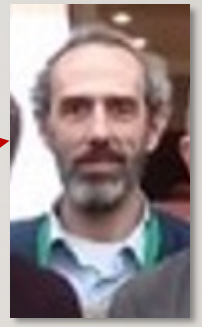
From: "10 awk Tricks That Feel Like Magic" @ magic.com - 2 September 2026

ERIK KUULKERS

TOMASO, DIPS, CYGNUS X-1

7 years ago…

The FOXT conference ("The Future of X-ray Timing")
21–25 October 2019 – De Rode Hoed, Amsterdam, The Netherlands

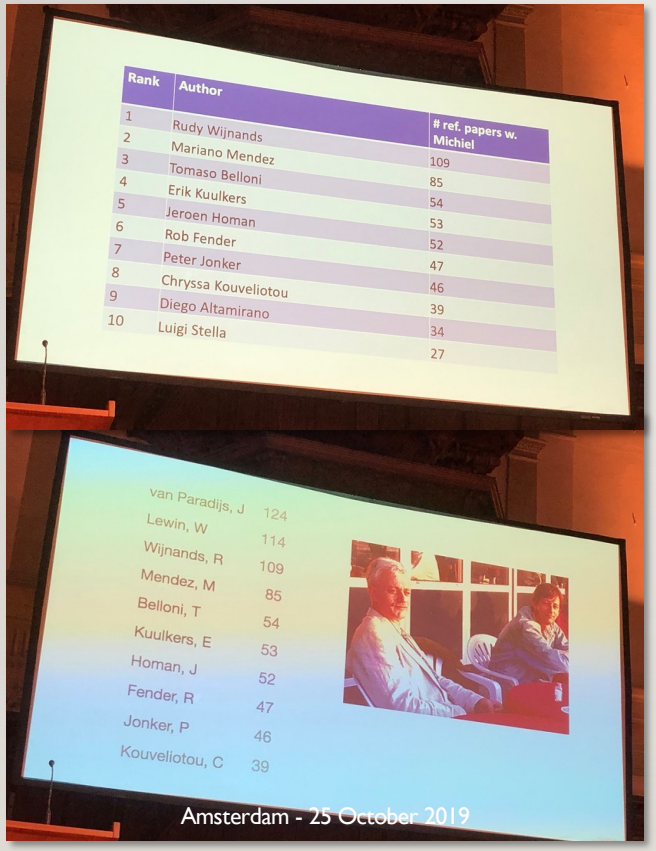


ERIK KUULKERS

TOMASO, DIPS, CYGNUS X-1

7 years ago…

The FOXT conference ("The Future of X-ray Timing")
21–25 October 2019 – Amsterdam, The Netherlands



Refereed papers with Michiel van der Klis

Rank	Author	# ref. papers w. Michiel	
1	van Paradijs	120	
2	Lewin	115	
3	Wijnands	104	
4	Mendez	82	
5	Belloni	55	
6	Homan	55	↓
7	Kuulkers	51	↓
8	Fender	44	
9	Jonker	43	
10	Ingram	40	New!
11	Altamirano	37	↑
12	Kouveliotou	36	↑
13	Stella	23	

28 August 2026
astrophysics data system

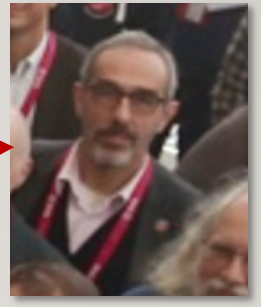
Michiel's 1st postdoc and 1st PhD student as professor at the UvA…

ERIK KUULKERS

TOMASO, DIPS, CYGNUS X-1

4 years ago…

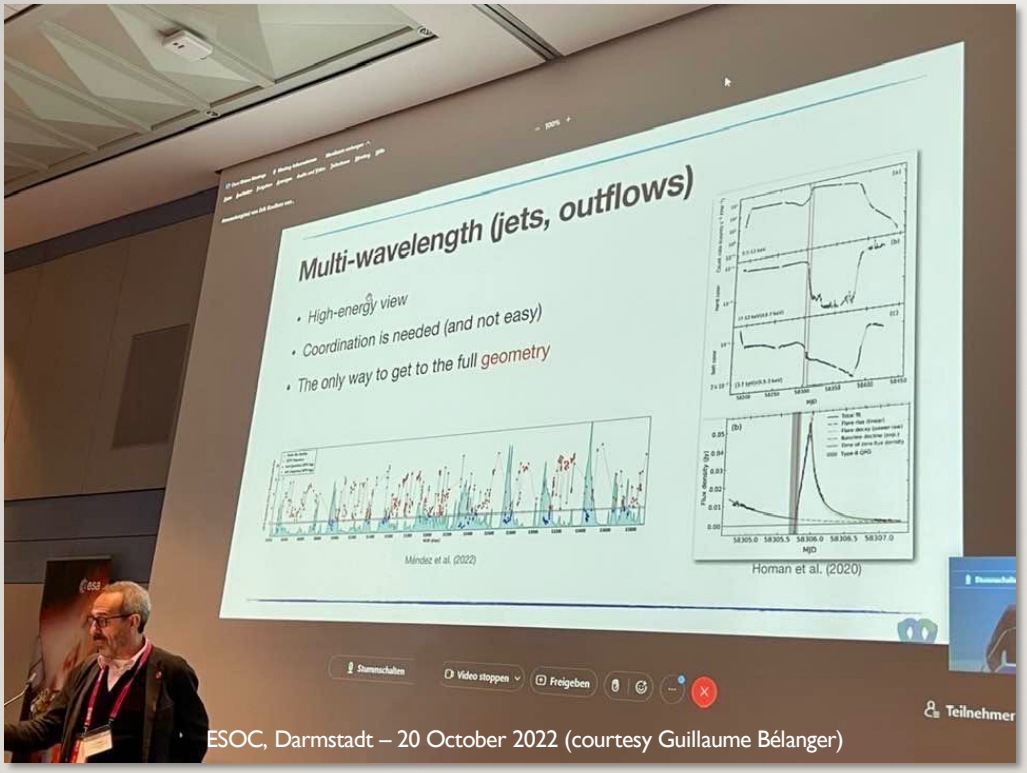
INTEGRAL 20 Years – Two Decades of High-Enery Astronomy with INTEGRAL
17–21 October 2022 – ESOC, Darmstadt, Germany



4 years ago…

INTEGRAL 20 Years – Two Decades of High-Enery Astronomy with INTEGRAL
17–21 October 2022 – ESOC, Darmstadt, Germany

Tomaso on future perspectives of black-hole physics with high-energy timing and spectral studies…



ESOC, Darmstadt – 20 October 2022 (courtesy Guillaume Bélanger)

ESOC, Darmstadt – 20 October 2022 (courtesy Guillaume Bélanger)

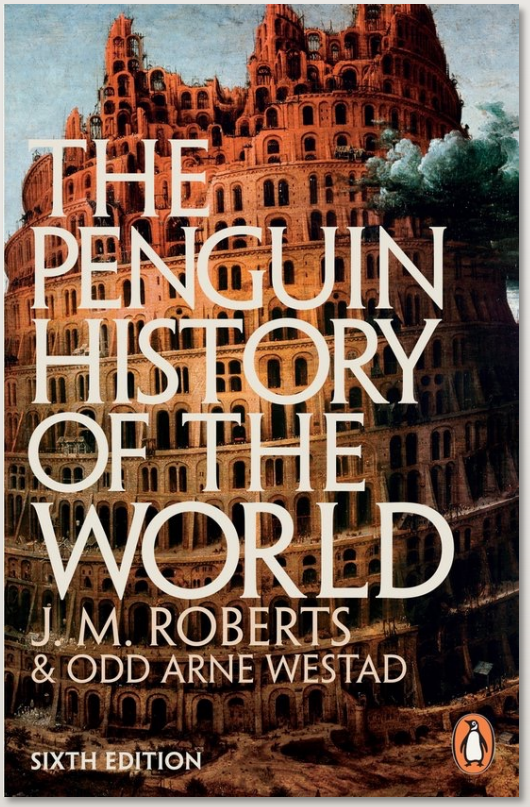
ERIK KUULKERS

TOMASO, DIPS, CYGNUS X-1

4 years ago…

INTEGRAL 20 Years – Two Decades of High-Enery Astronomy with INTEGRAL
20 October 2022 – Conference Dinner, Restaurant "Weststadt Bar"

Tomaso knows history & facts…



The History of the World by **J.M. Roberts** is one of the most acclaimed single-volume accounts of global human history, originally published in 1976. Spanning over 1,000 pages, this monumental work synthesizes thousands of years of human experience, from the evolution of early hominids to the dawn of the 21st century

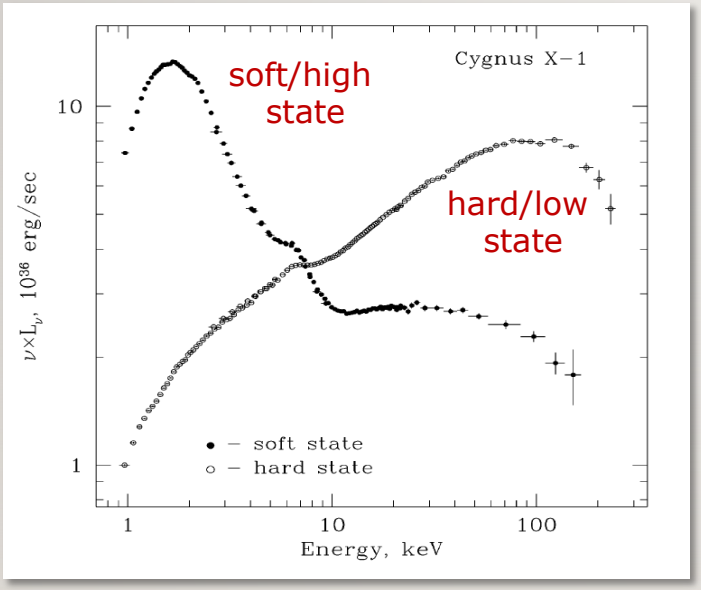
ERIK KUULKERS

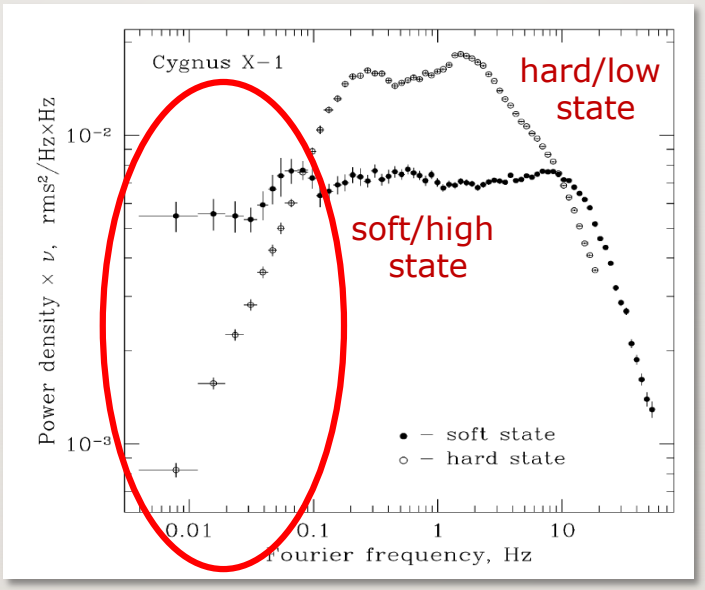
TOMASO, DIPS, CYGNUS X-1

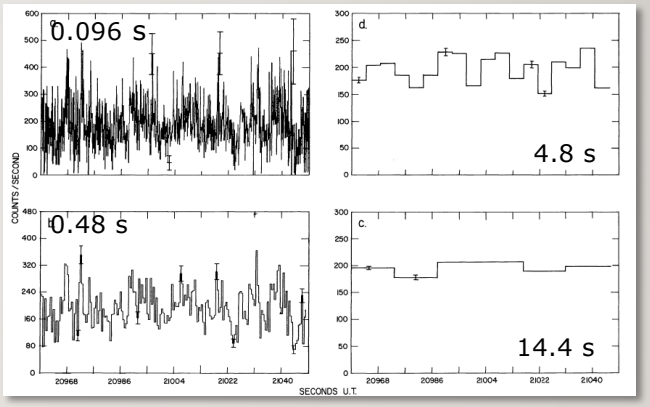
Many years ago…

Cygnus X-1 states

>1970







Schreier *et al.* 1971, ApJ 316, 923

RXTE/PCA & HEXTE

e.g, Gilfanov *et al.* 2000, MNRAS 316, 923

X-ray states in X-ray binaries are mainly defined by their spectra & timing behaviour.
These states correspond to different accretion regimes of the compact object:
Accretion rate **increases** from low to high state

ERIK KUULKERS

TOMASO, DIPS, CYGNUS X-1

20 years ago…

An Intermediate State of Cygnus X-1
1 December 1996 – ApJ 472, L107

"Flux, variability and spectral shape suggest […] that the source was in [May 1996] in an 'intermediate' state […]."
"Perhaps also the state transitions of Cyg X-1 observed in the 1970s were not to a high state but to this intermediate state."

THE ASTROPHYSICAL JOURNAL, 472:L107–L110, 1996 December 1

AN INTERMEDIATE STATE OF CYGNUS X-1

T. BELLONI,[1] M. MÉNDEZ,[1,2] M. VAN DER KLIS,[1] G. HASINGER,[3] W. H. G. LEWIN,[4] AND J. VAN PARADIJS[1,5]
Received 1996 July 11; accepted 1996 September 5

ABSTRACT

We report *RXTE*/PCA observations of the black hole candidate Cygnus X-1. In 1996 February the source was in its usual "low" state. In three observations during 1996 May the source was on average brighter by a factor of 2 and showed less rapid variability and a softer energy spectrum. However, the observations indicate that Cyg X-1 did not enter a high state like the one observed in black hole transients. Flux, variability, and spectral shape suggest instead that the source was in an "intermediate" state similar to what has been observed in GS 1124−68 and GX 339−4. Perhaps also the state transitions of Cyg X-1 observed in the 1970s were not to a high state but to this intermediate state.

Subject headings: X-rays: stars — stars: individual (Cygnus X-1)

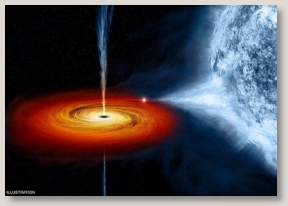
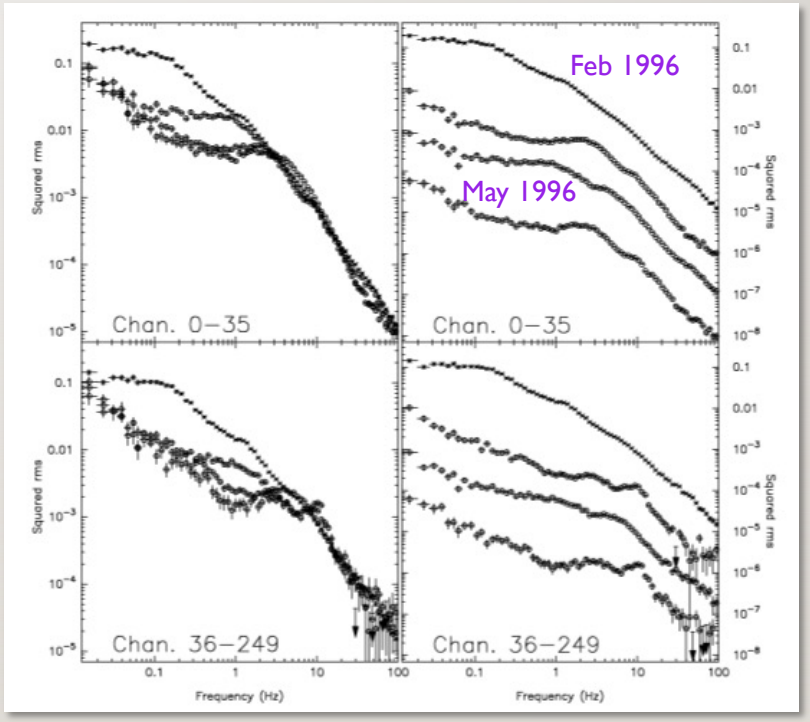


TABLE 1

OBSERVATION LOG

Date	UT Start	UT End	PCA Rate (ch. 0–35)	PCA Rate (ch. 36–249)
96 Feb 12	02:00	09:34	5040	2380
96 May 22....	17:45	19:49	9620	970
96 May 23....	14:14	18:08	9220	1280
96 May 30....	07:47	08:45	7260	710



Feb 1996: Low/Hard State – May 1996: Intermediate State

ERIK KUULKERS

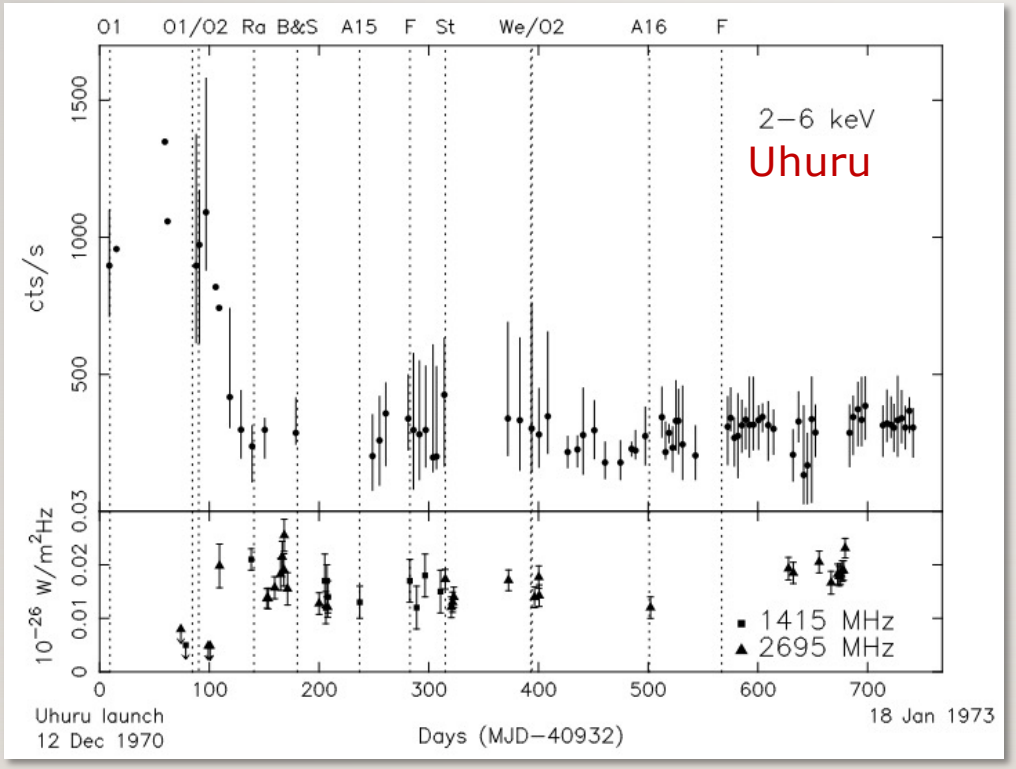
Beijing – 15 June 2016 (courtesy Tomaso)

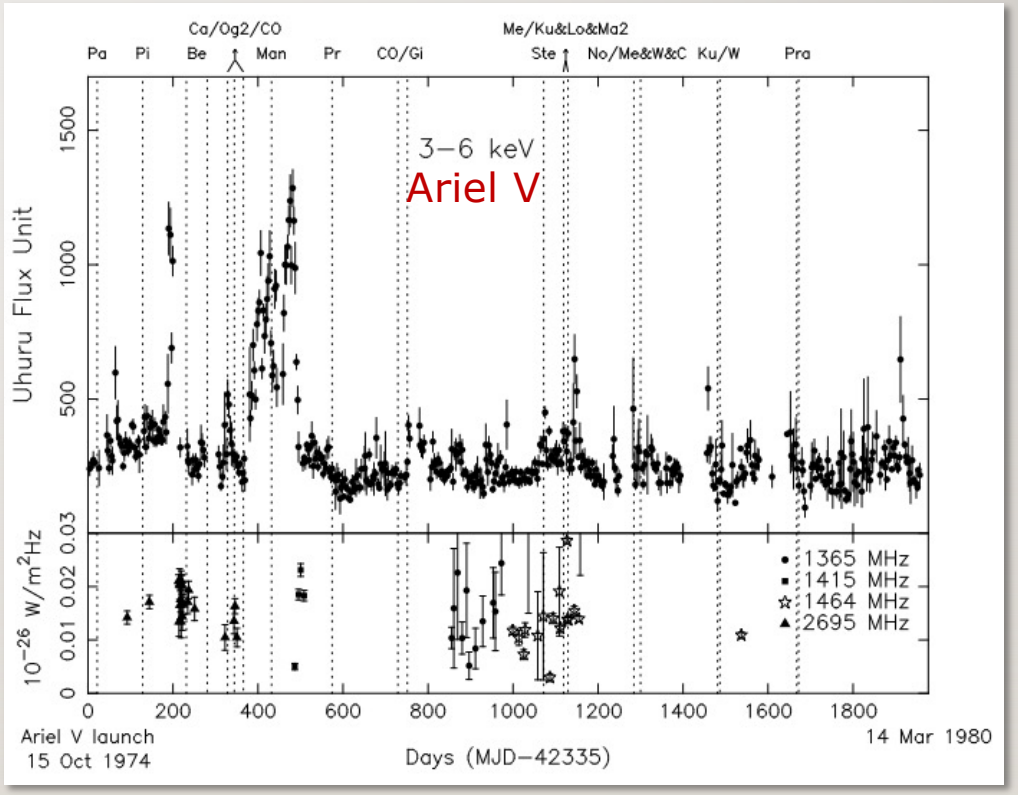
TOMASO, DIPS, CYGNUS X-1

0 years ago…

Cygnus X-1 revisited: fast variability behaviour and states in the 60s and 70s

<7 September 2026 – ESA/ESTEC, Noordwijk, The Netherlands





ERIK KUULKERS

TOMASO, DIPS, CYGNUS X-1

0 years ago…

Cygnus X-1 revisited: fast variability behaviour and states in the 60s and 70s

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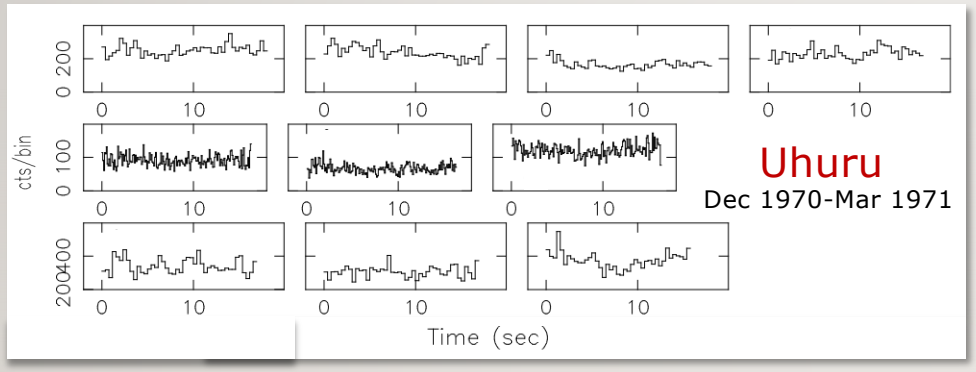
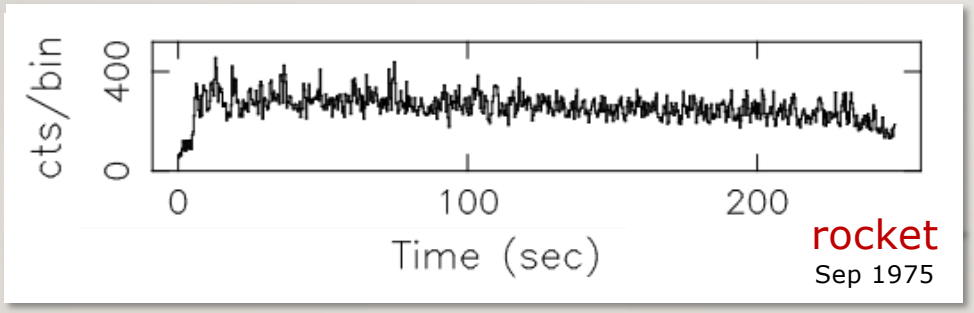
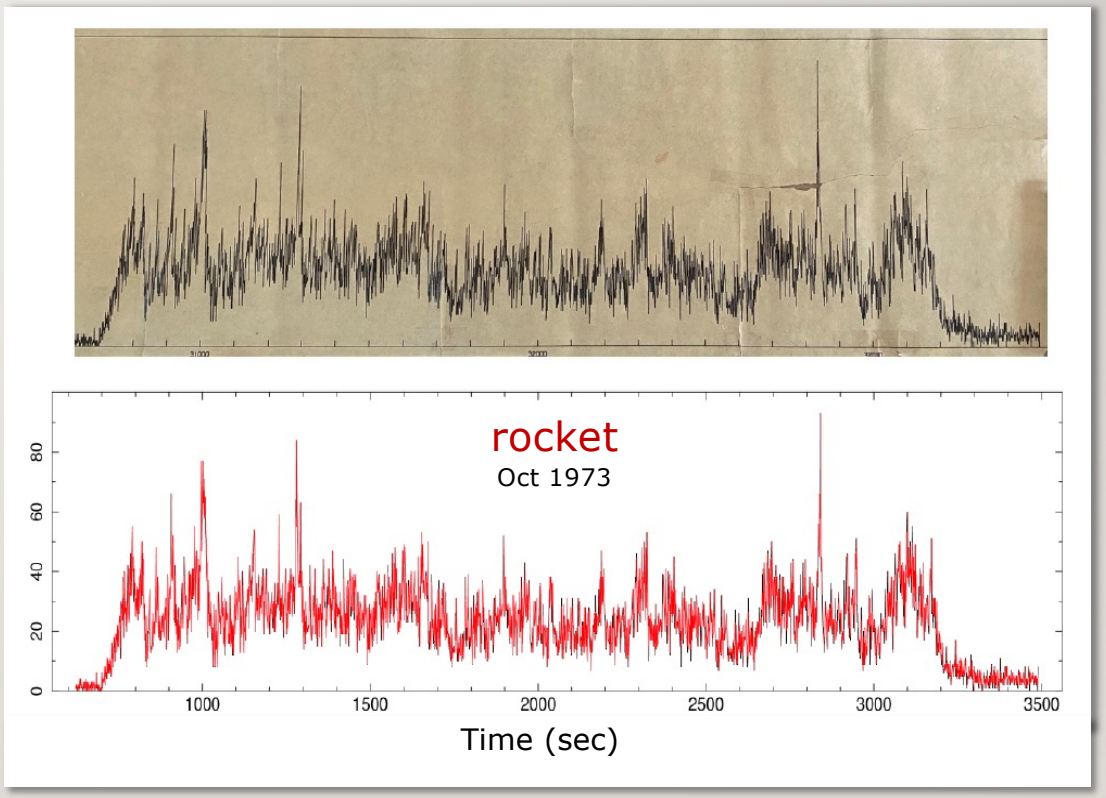


From: Oda *et al.* 1971, ApJ 166, L1; Oda *et al.* 1976, Ap&SS 42, 223 (0.096 s & 0.384 s)



From: Ogawara *et al.* 1977, Nat 270, 154 (0.32 s)



From: Rothschild *et al.* 1974, ApJ 189, L13 (20.48 ms)

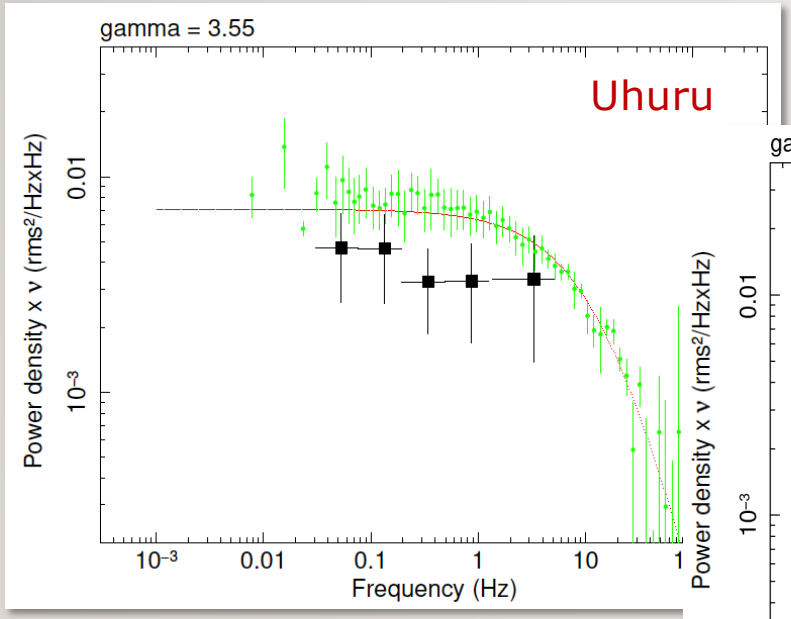
ERIK KUULKERS

TOMASO, DIPS, CYGNUS X-1

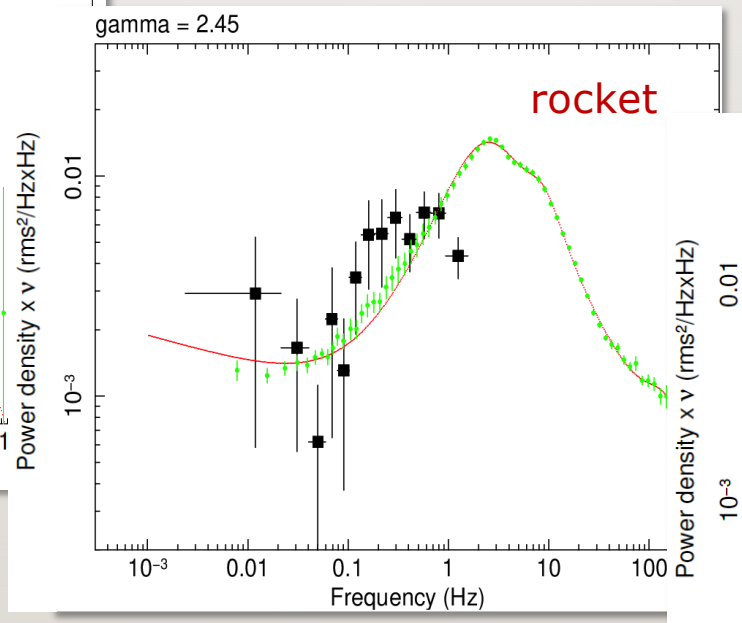
0 years ago…

Cygnus X-1 revisited: fast variability behaviour and states in the 60's and 70's

<7 September 2026 – ESA/ESTEC, Noordwijk, The Netherlands

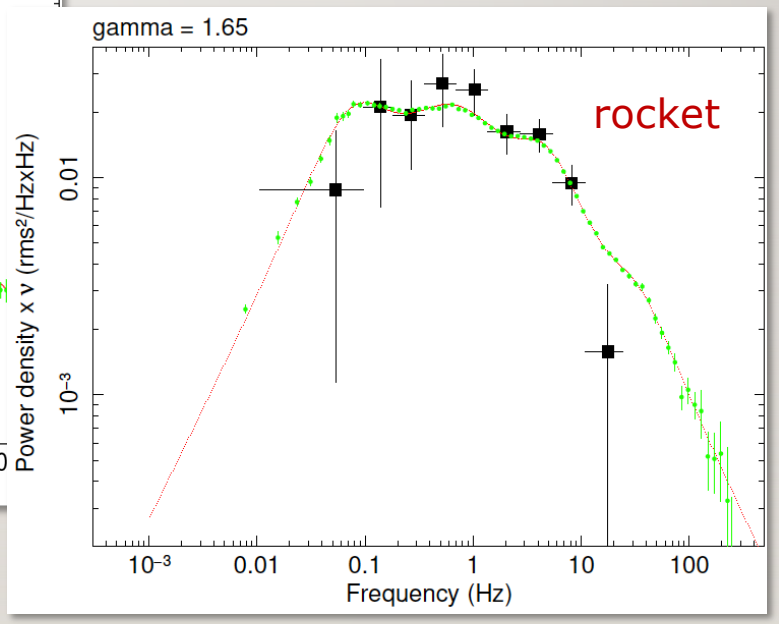


First soft/high-state power spectrum!



Intermediate state power spectrum

Low/hard state power spectrum



ERIK KUULKERS

TOMASO, DIPS, CYGNUS X-1

0 years ago…

Cygnus X-1 revisited: fast variability behaviour and states in the 60s and 70s

<7 September 2026 – ESA/ESTEC, Noordwijk, The Netherlands

Cygnus X-1 revisited: fast variability behaviour and states in the 60s and 70s

E. Kuulkers[1], A. Ingram[2], T. D. Russell[3], V. Grinberg[1], J. Wilms[4], K. Pottschmidt[5,6†], R.E. Rothschild[7], Y. Mollard[8], and More...?[9]

Tomaso was right…

"Perhaps also the state transitions of Cyg X-1 observed in the 1970s were not to a high state but to this intermediate state."

Conclusions:

- 60's/70's data are (not only) of historical value
- 60's/70's data enable us to compare results with those of much later measurements and interpret them in light of what we know nowadays
- 60's/70's data extend long-term baseline for characterizing state change behaviour in Cygnus X-1
- **Never throw away old data**: (Legacy) Archives are important!

Mission	detector	Date start[a] (UTC)	duration[b] (min)	time res. (s)	E_{range} (keV)	PHA info?	reference	ϕ_{orb}[c]	Fig. lc[e]	Fig. PDS
rocket	A/B	16 Jun 1964 09:04	0.025	0.00195	0.8–12.4	no	Bowyer et al. (1965b)	0.58	2	—
balloon		3 May 1967 09:20	330	60	20–41.4	yes	Bingham & Clark (1969)	0.26–0.30	3	—
rocket		8 Sep 1967 03:24	0.67	1	1–13	no	Shulman et al. (1971), Fritz et al. (1968)	0.08	12b	22j
balloon	UCSD	10 Jun 1969 09:00	50	60	20–200	no	Matteson et al. (1976)	0.59	4	—
rocket		21 Sep 1970 17:32	0.11	0.025	2–40	no	Holt et al. (1971), Bleach (1972)	0.22	8a	—
balloon	A/B	27 Sep 1970 10:41	5.2	2.08	13–80	yes	Ogawara et al. (1976)	0.24	6	—
UHURU	det-2	21 Dec 1970 07:57	0.42	0.384	2–6	no	Oda et al. (1971)	0.40	7a	22a
UHURU	det-2	21 Dec 1970 08:10	0.42	0.384	2–6	no	Oda et al. (1971)	0.40	7b	22a
UHURU	det-2	21 Dec 1970 08:24	0.42	0.384	2–6	no	Oda et al. (1971)	0.41	7c	22a
UHURU	det-2	21 Dec 1970 08:37	0.42	0.384	2–6	yes	Oda et al. (1971)	0.41	7d	22a
UHURU	det-2	6 Mar 1971 05:52	0.27	0.096	2–6	no	Oda et al. (1971)	0.78	7e	22a
UHURU	det-2	6 Mar 1971 10:51	0.27	0.096	2–6	no	Oda et al. (1971)	0.82	7f	22a
UHURU	det-2	6 Mar 1971 21:00	0.27	0.096	2–6	no	Oda et al. (1971)	0.89	7g	22a
UHURU	det-2	12 Mar 1971 05:21	0.38	0.384	2–6	yes	Oda et al. (1976)	0.85	7h	22a
UHURU	det-2	12 Mar 1971 06:43	0.34	0.384	2–6	yes	Oda et al. (1976)	0.86	7i	22a
UHURU	det-2	12 Mar 1971 08:05	0.35	0.384	2–6	yes	Oda et al. (1976)	0.87	7j	22a
UHURU	det-1	>Mar 1971	0.22	0.192	2.1-19.8	yes	Jones Forman (1974)	—	7l	—
rocket		1 May 1971 09:39	1.46	0.1	1.5–10	no	Rappaport et al. (1971a)	0.81	8d	22b
"		"	0.11,0.21	0.04	"	"	Oda et al. (1976)	"	8b,c	22b
UHURU	det-1	10 Jun 1971 00:50	0.83	0.192	2.1–12	yes	Brinkman et al. (1974b)	0.89	7k	22k
UHURU	det-2	10 Jun 1971 05:49	1.48	0.48	2–6	no	Schreier et al. (1971)	0.92	7m	—
Apollo 15	XRFS	5 Aug 1971 20:09	55	8	0.69–>3	yes	Adler et al. (1972b), this work	0.03–0.04	10a	22g
balloon		20 Sep 1971 20:30	60^{+1}	2	30–100	no	Frontera & Fuligni (1975b); Frontera et al. (1975)	0.25	5a	—
rocket	C&D	23 Oct 1971 03:47	0.17	0.1	0.2–2.5	no	Stevens et al. (1972)	0.02	7r	—
UHURU	det-1	9 Jan 1972	0.53	0.192	2.1-16.4	no	Weisskopf et al. (1975)	0.92–0.10	7n	—
UHURU	det-1	9–27 Jan 1972	21	0.192	2.1-16.4	PDS	Weisskopf et al. (1975)	—	—	22i
UHURU	det-1	9 Jan 1972 scan #4	0.28	0.096	2.4–6.9	yes	Oda et al. (1976)	0.92–0.10[d]	7o	22c
UHURU	det-1	10 Jan 1972 scan #6	0.27	0.096	2.4–6.9	yes	Oda et al. (1976)	0.10–0.27[d]	7p	22c
UHURU	det-1	11 Jan 1972 scan #1	0.21	0.096	2.4–6.9	yes	Oda et al. (1976)	0.27–0.45[d]	7q	22c
Apollo 16	XRFS	27 Apr 1972 03:45	56	24	0.7–>3	no	Adler et al. (1972a)	0.41–0.42	9	—
balloon		1 Jul 1972 00:35	100^{+2}	2	30–100	no	Fuligni & Frontera (1973); Frontera & Fuligni (1975b); Frontera et al. (1975); Frontera & Fuligni (1975a)	0.99-0.01	5b	24
balloon		1 Jul 1973 00:35[e3]	100^{+2}	2	30–100	no	Frontera & Fuligni (1975b);	0.17–0.19	5c	—
Copernicus	UCLXE	4 Sep 1973 13:12	843	86.5[e]	2.5–7.5	no	Mason et al. (1974), this work	0.88–0.98	11a	—
rocket	XRPC	4 Oct 1973 03:45	0.82	0.02048	1.5–35	no	Rothschild et al. (1974)	0.16	8e	22n
Copernicus	UCLXE	30 Oct 1973 20:38	852	86.5[e]	2.5–7.5	no	Mason et al. (1974), this work	0.93–0.04	11b	—
ANS	SXX	5 Nov 1974 17:40	12.2	16	0.6–8	no	Parsignault et al. (1976)	0.16	12b	22b
balloon		20 Feb 1975 14:59	72	32	34–64	no	Pietsch (1980)	0.25–0.26	17c	—
Salyut 4	Filin	3 Jun 1975 13:55	40	1.0[e]	2–10	yes	Berezhnoy et al. (1977)	0.63–0.64	13a	—
Salyut 4	Filin	22 Jul 1975 15:40	25	0.66[e]	2–10	yes	Berezhnoy et al. (1977), Kurt et al. (1976)	0.40	13b	—
SAS-3	slat	8 Sep 1975 07:41	22.2	1.6	1.5–15	yes	Canizares et al. (1976)	0.91	14a	22f
SAS-3	slat	8 Sep 1975 11:31	22.2	1.6	1.5–15	yes	Canizares et al. (1976)	0.94	14b	22f
rocket		24 Sep 1975 03:45	0.82	0.32	1.5–25	no	Ogawara et al. (1977)	0.74	15a	22e
SAS-3	slat	15 Oct 1975 13:38	5.0	0.83	1–55	no	Canizares & Oda (1977)	0.56	14c	22h
COS-B	X-ray[f]	20 Dec 1975 20:44	254.6	102.4	2–12	no	Manzo et al. (1978)	0.40–0.43	16	22d
rocket	LED+MED	11 May 1976 03:45	84	0.1024	0.6–20	yes	Priedhorsky et al. (1979)	0.81	8f	22l
SAS-3	slat	12 Oct 1976 17:07	17.3	0.83	1–55	no	Canizares & Oda (1977)	0.41	14d	22o
SAS-3	slat	12 Oct 1976 20:08	17.3	0.83	1–55	no	Canizares & Oda (1977)	0.43	14e	22o
SAS-3	slat	13 Oct 1976 10:05	17.3	0.83	1–55	no	Canizares & Oda (1977)	0.54	14f	22o
rocket		4 Nov 1976 07:47	0.13	0.008192	1.5–12	yes	Giles (1978)	0.45	12a	—
balloon		21 Sep 1977 04:32	11.4	2.048	15–150	no	Steinle (1980)	0.75	17b	23b
balloon		21 Sep 1977 04:35	14	0.4096	15–150	no	Steinle (1980)	0.75	17b	23b
balloon		21 Sep 1977 05:19	12	2.048	15–150	no	Steinle (1980)	0.75	17a	23a
balloon		21 Sep 1977 05:33	0.9	0.4096	15–150	no	Steinle (1980)	0.76	17a	23a
HEAO-1	A-1	6 Nov 1977 10:02	0.33	0.04	1.5–20	no	Meekins et al. (1979), Friedman (1979)	0.00	7s	—
HEAO-1	A-1	7 Nov 1977 12:18	0.33	0.04	0.25–25	no	Meekins et al. (1979)	0.20	7t	—
HEAO-1	A-2/MED	17 Nov 1977 19:08	222	5.12	1.5–20	no	this work	0.03–0.06	10b	—
HEAO-1	A-2/MED+HED	17 Nov 1977 19:08	46	0.08	1.5–60	PDS	Lochner et al. (1991)	0.03–0.06	—	22q
HEAO-1	A-4	17 Nov 1977 19:08[g]	1	0.16	14–160	yes	Matteson (1979)	0.89–0.07	8g	22q
HEAO-1	A-4	21 Apr 1978 06:47	8.9	1.28	11–31	no	Nolan et al. (1981)	0.62	15b	22p
HEAO-1	A-4	21 Apr 1978 06:11	217	0.16	11–137	PDS	Nolan et al. (1981)	0.62–0.66	—	22p
HEAO-1	A-1	7 May 1978 02:48	8.5	0.04	1–25	no	Meekins et al. (1984)	0.45	13c	—
HEAO-1	A-1	7 May 1978 02:48	8.5	0.0000078	1–25	PDS	Wen (1997), Chaput et al. (2000)	0.45	—	22m
HEAO-1	A-2/MED	4 Nov 1978 07:28	268	5.12	1.5–20	no	this work	0.81–0.84	10c	—
HEAO-1	A-1	9 Nov 1978 17:26	8.5	0.0000078	1–25	PDS[h]	Wen (1997)	0.77	—	22m
Einstein	SSS	9 May 1979 09:38	492	25.6	0.8–4	no	Pravdo et al. (1980)	0.04–0.1	XX	XX
Einstein	MPC	9 May 1979 09:38	492	25.6	2–15	no	Pravdo et al. (1980)	0.04–0.1	XX	XX
Einstein	SSS	13 May 1979 21:14	121	25.6	0.8–4	no	Pravdo et al. (1980)	0.84–0.85	XX	XX
Einstein	MPC	13 May 1979 21:14	121	25.6	2–15	no	Pravdo et al. (1980)	0.84–0.85	XX	XX

ERIK KUULKERS

TOMASO, DIPS, CYGNUS X-1

3 years ago…

Cerimonia Funebre Dr. Tomaso M. Belloni

30 August 2023 – Parrocchia di San Pietro in Sala, Milan/Fiera, Italy

Last farewell…

Milan/Fiera - 30 August 2023

Thank you, Tomaso. Will miss you and our … yip yip … dips.

National Centre for Performing Arts, Beijing - 13 May 2015

Quote from teamLab Borderless, Tokyo – 21 July 2024

ERIK KUULKERS

TOMASO, DIPS, CYGNUS X-1

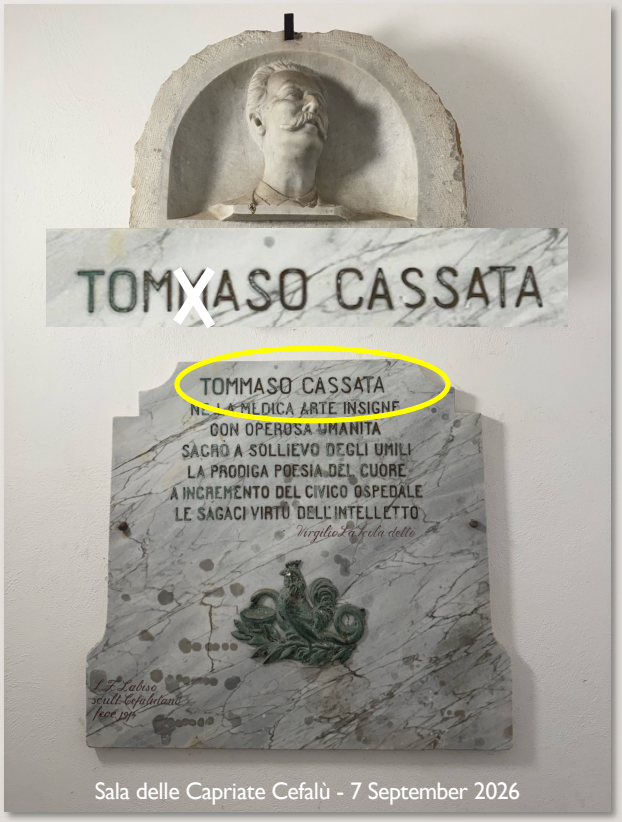
0 years ago… good to be back!

"The many tones of accretion - to the memory of Tomaso Belloni"

7–11 September 2026 – Sala delle Capriate, Cefalù, Sicily, Italy

Sala delle Capriate Cefalù - 7 September 2026


Sala delle Capriate Cefalù - 7 September 2026



Sala delle Capriate Cefalù - 7 September 2026

0 years ago…

A memorial to Tomaso Belloni by Claude & ChatGPT

8 September 2026 – Sala delle Capriate, Cefalù, Sicily, Italy

TOMASO BELLONI
"NE LA CELESTE ARTE INSIGNE
CON ACUTO INGEGNO
TRASSE A LUME DEI MORTALI
LA SOTTILE SCIENZA DEGLI ASTRI
A INCREMENTO DEL PATRIO
OSSERVATORIO
LE SAGACI VIRTÙ DELL'INTELLETTO"

Courtsey: Claude

Tomaso Belloni
"Distinguished in the celestial art,
with keen intellect he drew into the light
of mortals the subtle science of the stars,
to the increase of the native observatory
the sagacious virtues of the intellect."

"Celeste arte" stands in for astronomy where the original had "medica arte"; "lume dei mortali" plays on his work with light/X-rays illuminating human understanding; "patrio osservatorio" nods to Brera, the institution he led and enlarged as Belloni's real counterpart to the original's "civico ospedale."