

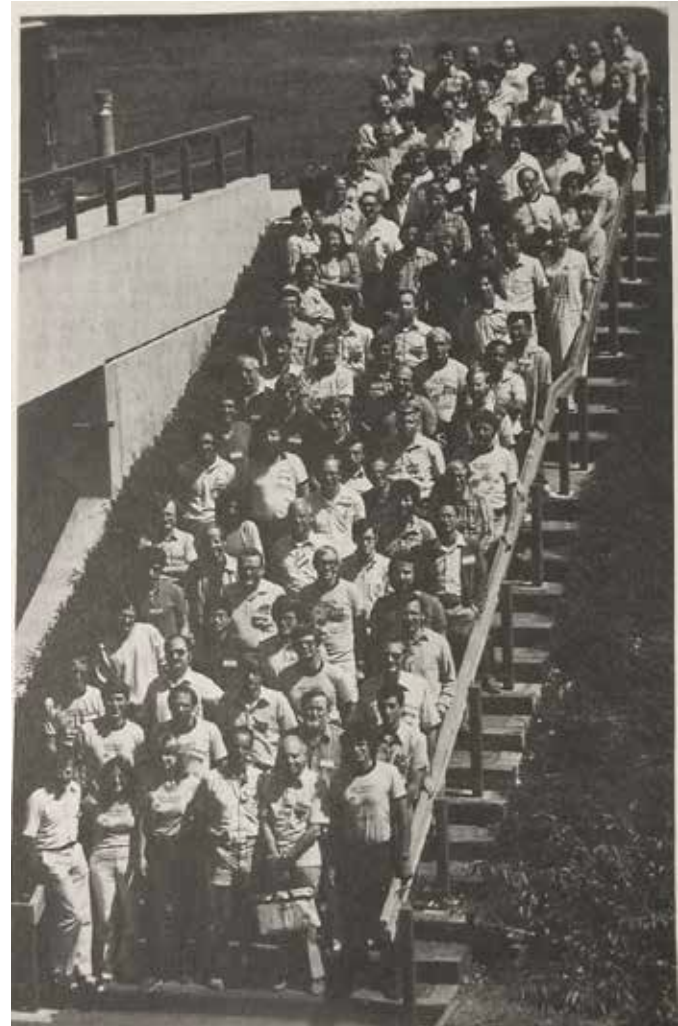
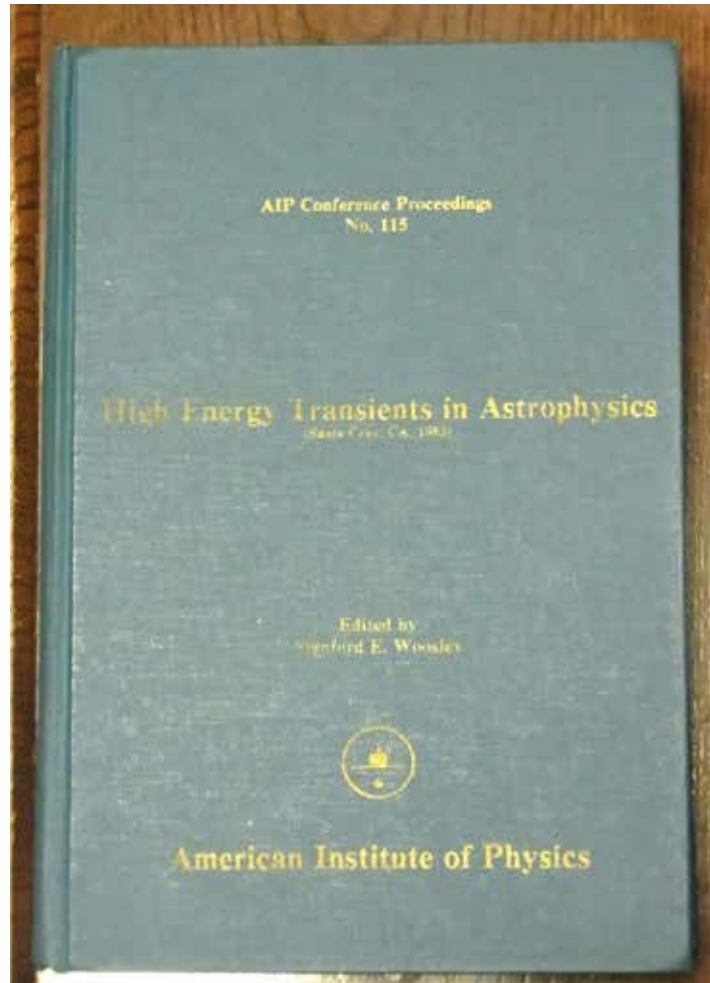
# MAXI-Swift Collaboration

Nobuyuki Kawai (Tokyo Tech)

On behalf of the MAXI Team

The Neil Gehrels Memorial Symposium  
The National Academy of Sciences, May 21-22, 2018

# “High Energy Transients in Astrophysics” Santa Cruz 1983





Kawai

Klebesadel

Gehrels

Precursor

**All-Sky X-Ray Observations in the Next Decade**  
— a workshop for ASM and GRB missions in X-ray band —  
RIKEN, Wako, Saitama Japan, March 3-5, 1997







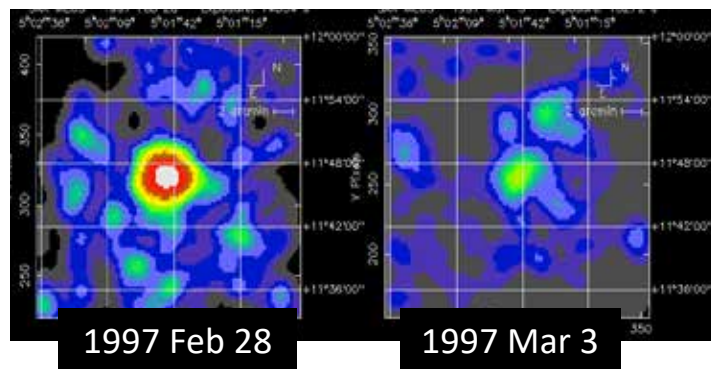
**All-Sky X-Ray Observations in the Next Decade**  
— a workshop for ASM and GRB missions in X-ray band —  
RIKEN, Wako, Saitama Japan, March 3-5, 1997

# March 1997

- ROSAT, ASCA, and RXTE operational in orbit
- CGRO/BATSE was actively observing GRBs
- High Energy Transient Experiment (HETE-1) launch failed in November 1996.
- BeppoSAX launched in April 1996.
- MAXI on JEM/ISS proposed for AO in 1996
  - Selected in April 1997

# On March 5, 1997 (not March 5, 1979)

- We invited Enrico Costa, but he canceled attendance just a few days before the workshop.
- Luigi Piro, though present in the meeting, was not in the group photo taken on the second day (March 4).
- On March 5, Luigi announced discovery of X-ray afterglow of **GRB970228** in his talk.
- Immediately, Chryssa stood up, and made a remark that her group was making optical observation of the location





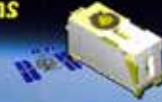
Neil proposed Swift in 1998

Swift was launched in 2004



## Astrophysics with All-Sky X-Ray Observations — 3<sup>rd</sup> International MAXI Workshop —

RIKEN Symposium 10-12 June, 2008



Organized by [RIKEN](#) & [JAXA](#)

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## "Astrophysics with All-Sky X-Ray Observations"

"-- 3rd international MAXI Workshop --"

Suzuki Umetaro Hall, RIKEN

Wako, Saitama, Japan  
RIKEN Symposium, 10-12 June, 2008

Organized by [RIKEN](#) & [JAXA](#)

**Proceedings are ready. (2009.2.19)**

[Go to proceedings page.](#)

**!!!Thank you very much for your participation !!!**



# June 2008

- BeppoSAX and HETE-2 already decommissioned
- RXTE, *Chandra*, XMM-Newton, INTEGRAL, *Suzaku*, and AGILE operational in orbit
- GLAST (to be named *Fermi*) was about to be launched.
- Swift's 5<sup>th</sup> year in orbit
  - Shifting from a GRB mission to an observatory
- MAXI in NASA/JSC, waiting for the fixing of external tank leak problems of the space shuttle.

**Astrophysics with All-Sky X-Ray Observations**  
— 3rd International MAXI workshop—  
RIKEN, Wako, Saitama Japan, June 10-12, 2008







Dan

Dave

Neil

Dave





# Neil at the banquet



At the  
Tour to  
JAXA  
Tsukuba  
Space  
Center





## Non-GRB X-ray and Hard X-ray Observations with *Swift*

Neil Gehrels  
NASA-GSFC

MAXI Workshop  
June 12, 2008

## "The Dream Team" MAXI + Swift + GLAST

- 3 sensitive sky monitors with large sky coverage on short timescales
- All 3 in low Earth orbit
- Sky coverage every 90 minutes in complementary energy bands:
  - \* MAXI 0.5 - 30 keV
  - \* BAT 15 - 350 keV
  - \* LAT 30 MeV - 300 GeV
- Similar ~1 mCrab sensitivities

## "The Dream Team" US Basketball Team at 1992 Olympics

Michael Jordan  
Magic Johnson  
Larry Bird  
Charles Barkley  
David Robinson  
Patrick Ewing  
Karl Malone  
Scottie Pippen  
Chris Mullin  
Clyde Drexler  
John Stockton  
Christian Laettner



## "The Dream Team" US Team Stunned at 2004 Olympics



Neil's Talk at MAXI workshop, June 2008

# TOOs for MAXI Transients & GRBs

- *Swift* can perform rapid X-ray and optical observations of MAXI transients
- TOO rapidly uploaded as RA & DEC. Response time is <1 hour to 1 day
- Web page for TOO requests  
<http://www.swift.psu.edu/too.html>
- Duty scientists always on call for urgent TOOs
- New "command from home" mode for after-hour TOOs
- Expert international teams provide rapid advice
  - \* GRB follow-up (48 members)
  - \* Supernova (22 members)
  - \* CVs & novae (24 members)
  - \* Hard X-ray survey (18 members)
  - \* AGN (4 members)
  - \* GeV and TeV  $\gamma$ -rays (4 members)
- Daily planning telecon to decide schedules

Neil's Talk at MAXI workshop, June 2008



## MAXI / Swift collaboration

3 messages

**David Burrows** <burrows@astro.psu.edu>  
To: Nobuyuki Kawai <nkawai@phys.titech.ac.jp>  
Cc: gehrels@milkyway.gsfc.nasa.gov

Fri, Jun 13, 2008 at 7:46 AM

Dear Nobu and Neil,

I had another idea about a joint meeting of Swift and MAXI team members to discuss coordination between the two missions. Suppose we plan a joint meeting in early 2009 (say late January or February) to be held in Hawaii? I am thinking of a meeting that would involve the Swift team members interested in various types of transient phenomena together with the MAXI team. We could have some science talks and some discussions about how to best cooperate on operations issues. Hawaii might be a reasonable mid-point between the US and Japanese participants. In that

**Nobuyuki Kawai** <nkawai@phys.titech.ac.jp>  
To: burrows@astro.psu.edu  
Cc: gehrels@milkyway.gsfc.nasa.gov

Fri, Jun 13, 2008 at 8:50 AM

Dear Dave,

I think it is an excellent idea. The last week of January or the first week of February may work for us too.

**Neil Gehrels** <gehrels@milkyway.gsfc.nasa.gov>  
To: Nobuyuki Kawai <nkawai@phys.titech.ac.jp>  
Cc: burrows@astro.psu.edu

Fri, Jun 13, 2008 at 3:19 PM

Dave,

Yes, this seems like a good idea to me. I could attend in late January or early February.

Neil

[Quoted text hidden]



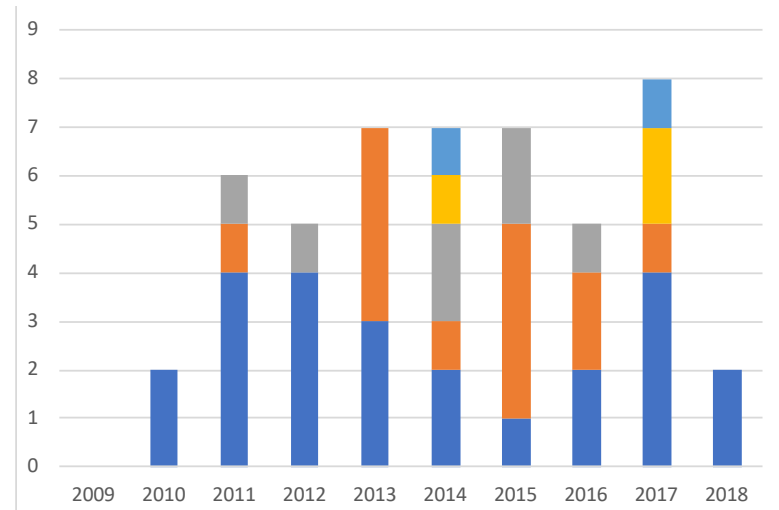
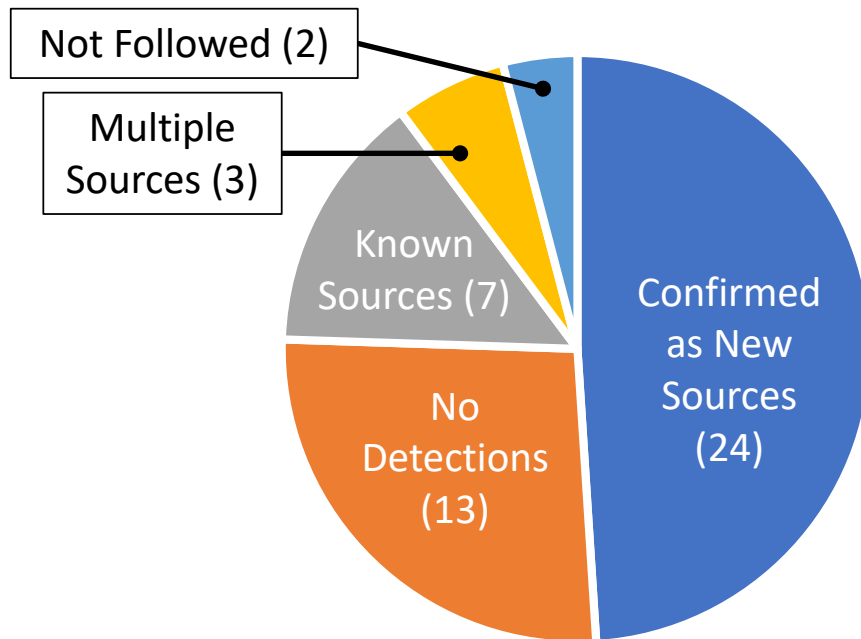
Swift-MAXI  
meeting  
Jan 21-22,  
2009



# Swift Follow-up of MAXI Transients

Swift GI PI: Jamie Kenea

49 in September 2010 – March 2018)



# Swift Follow-up of MAXI Transients

Swift GI PI: Jamie Kenea

49 in September 2009 – March 2018)

Source Name	Report	Yr/Mo/Dy	Swift	ID
<b>MAXI J1820+070</b>	atel 11399	2018/03/11	+	<b>BH</b>
MAXI J1813-095	atel 11323	2018/02/20	+	
MAXI J1630-276	atel 10984	2017/11/18	(-)	
MAXI J1621-501	atel 10869	2017/10/19	+	NS
MAXI J1749-20	atel 10821	2017/10/05	?	
Swift J0243.6+6124	atel 11198	2017/09/30	+	NS
MAXI 1055-588	mail	2017/09/22	-	
<b>MAXI J1535-571</b>	<b>Atel 10699</b>	<b>2017/09/03</b>	+	<b>BH</b>
MAXI J2003+336	mail	2017/05/11	?	GRB
MAXI J1807+132	Atel 10208	2017/03/25	+	NS
GRB161123A	GCN 20203	2016/11/23	-	
MAXI J0636+146	ATel 9707	2016/11/04	+	
MAXI J0058-721	ATel 9348	2016/08/09	C	NS
MAXI J0758-456	ATel 8983	2016/04/24	-	
MAXI J0911-655	ATel 8872	2016/03/26	+	NS
MAXI J0051-736	ATel 8088	2015/09/24	C	NS
MAXI J1714-130	ATel 8050	2015/09/13	-	
MAXI J1501-026	ATel 7954	2015/08/26	-	
MAXI J1957+032	ATel 7504	2015/05/14	+	
MAXI J1540-158	GCN17568	2015/03/12	-	
MAXI J0511-522	ATel 7200	2015/03/11	-	
MAXI J1739-301	ATel 6900	2015/01/11	C	NS
MAXI J1619-383	ATel 6708	2014/11/17	NA	
MAXI J1932+091	Atel 6174	2014/05/27	+	
MAXI J0545+043	ATel 6066	2014/04/13	-	

Source Name	Report	Yr/Mo/Dy	Swift	ID
MAXI J0243-582	ATel 6012	2014/03/26	C	AGN
MAXI J1930+093	ATel 5943	2014/03/04	C	AGN
MAXI J0057-720	ATel 5925	2014/02/27	?	
MAXI J1421-613	ATel 5750	2014/01/09	+	NS
MAXI J0620+053	GCN 15609	2013/12/25	-	
MAXI J1828-249	Atel 5474	2013/10/16	+	BH
MAXI J1735-304	Atel 5096	2013/06/01	+	NS
MAXI J1738-277	MAXI mail	2013/05/27	-	
MAXI J1807+196	Atel 5075	2013/05/20	+	NS
MAXI J1707-170	MAXI Mail	2013/04/24	-	
(MAXI J1334-618)	no report	2013/03/04	-	
(MAXI J1741-654), GRB 121225A	GCN 14100	2012/12/25	+	NS
MAXI J1807-228	Atel 4335	2012/08/25	C	NS
MAXI J1647-227	Atel 4175	2012/06/15	+	NS
MAXI J1910-057 / Swift J1910.2-0546	Atel 4140	2012/06/-1	+	BH
MAXI J1305-704	Atel 4024	2012/04/10	+	BH
<b>MAXI J0158-744</b>	<b>Atel 3756</b>	<b>2011/11/11</b>	+	<b>CV</b>
MAXI J1836-194	Atel 3611	2011/08/30	+	BH
MAXI J1543-564	Atel 3330	2011/05/08	+	BH
MAXI J1631-639	Atel 3316	2011/04/30	-	
MAXI J1745-288	Atel 3123	2011/01/27	C	NS
MAXI J0556-332	Atel 3102	2011/01/12	+	NS
MAXI J1409-619	Atel 2959	2010/10/20	+	NS
MAXI J1659-152	Atel 2873	2010/09/25	+	BH



# X-ray New “MAXI” Transients/Novae

Negoro+ 2016

**6 (+1) X-ray novae were newly discovered in the last 3 yrs.**

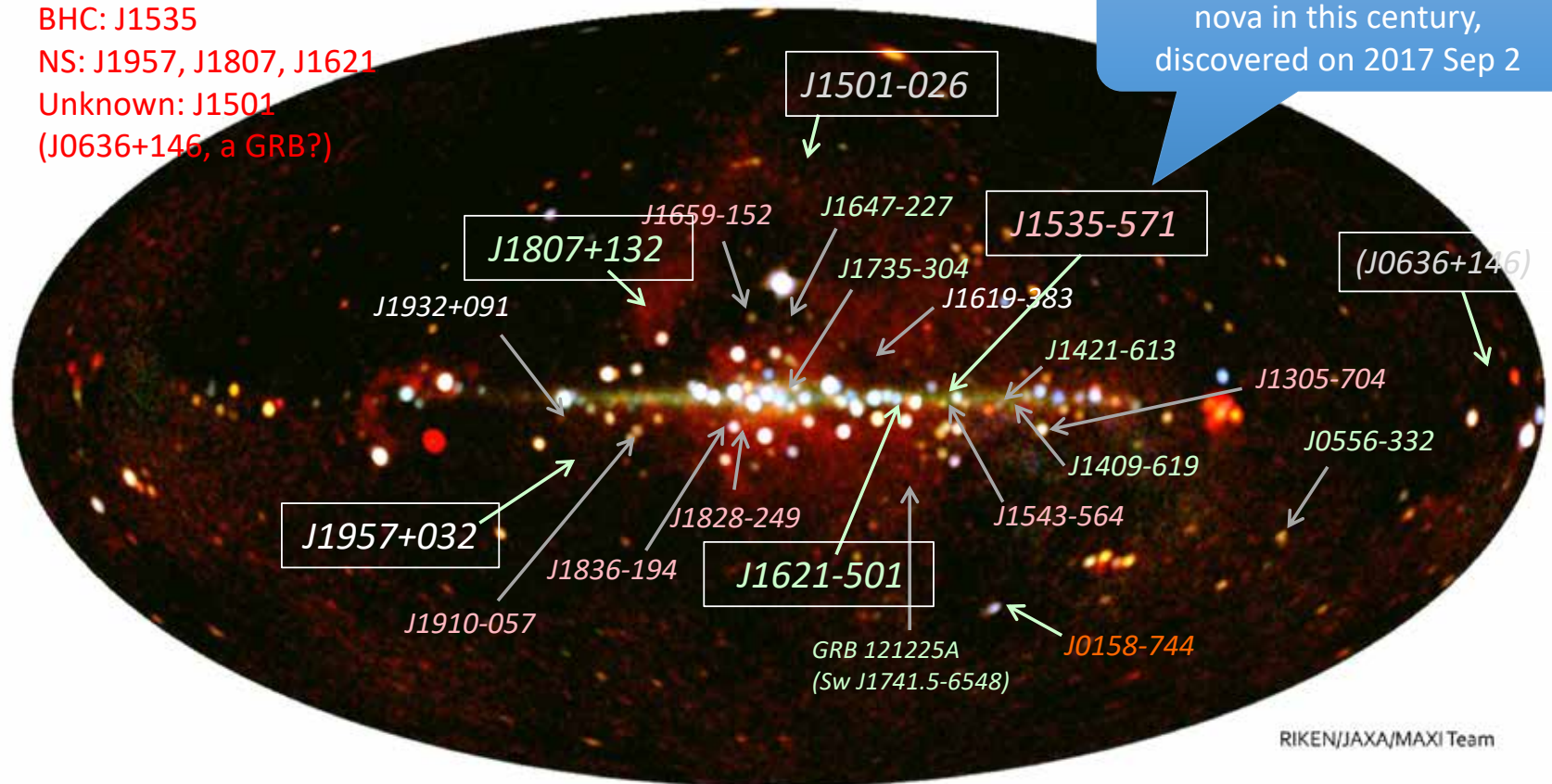
BHC: J1535

NS: J1957, J1807, J1621

Unknown: J1501

(J0636+146, a GRB?)

Brightest Black Hole X-ray  
nova in this century,  
discovered on 2017 Sep 2

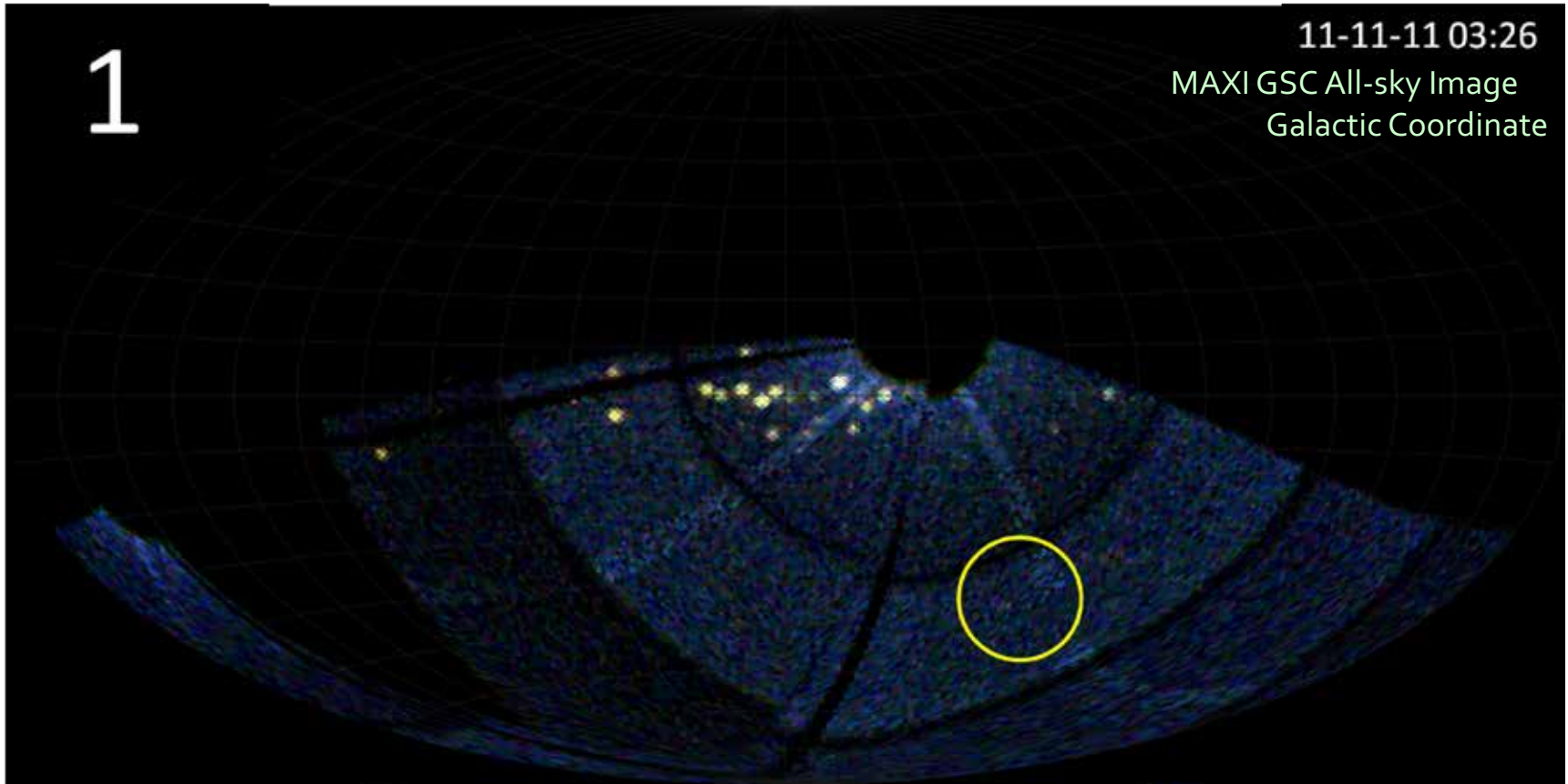


Total 21 : 7 black holes, 11 neutron stars, 1 white dwarf and 1(+1) unknown.



# MAXI J0158-744: unique soft X-ray transient

24

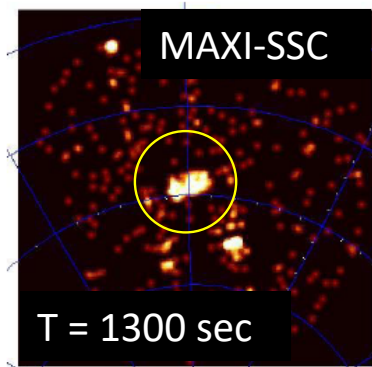
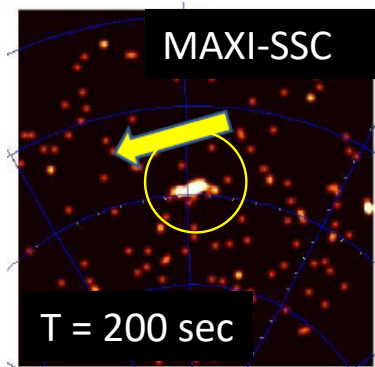
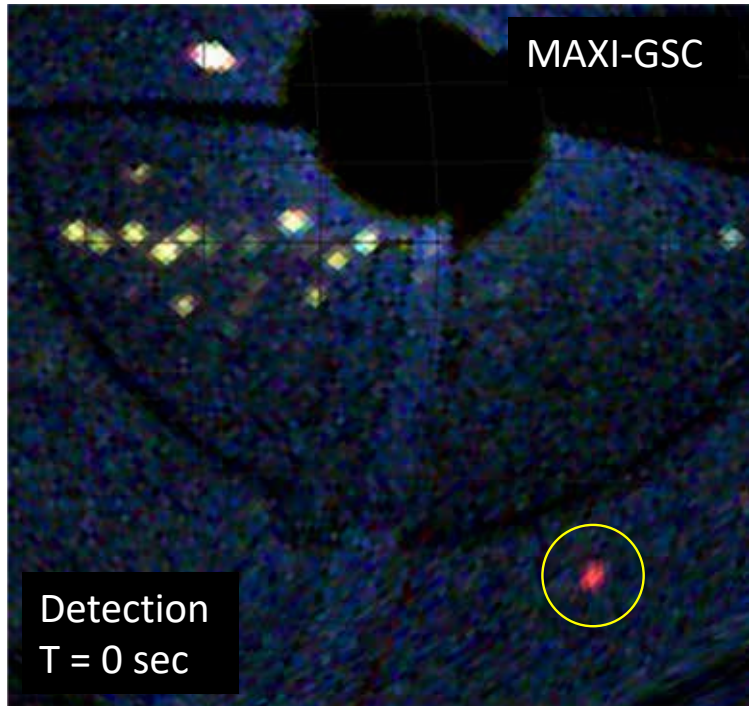


- 2011-11-11 05:05:59 (UT)
- GRB 111111A
- Soft X-ray transient ( $< 5$  keV)

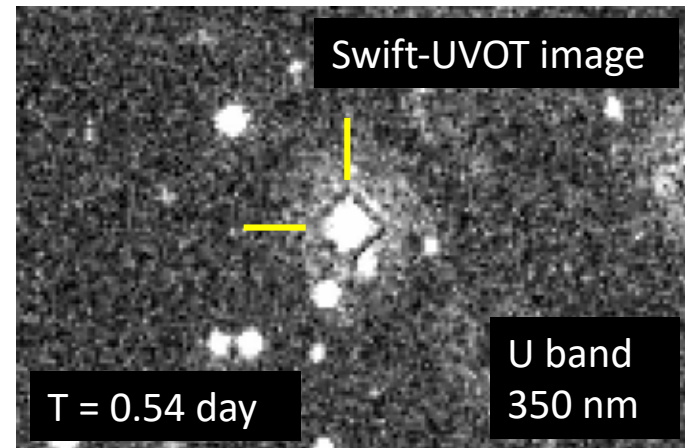
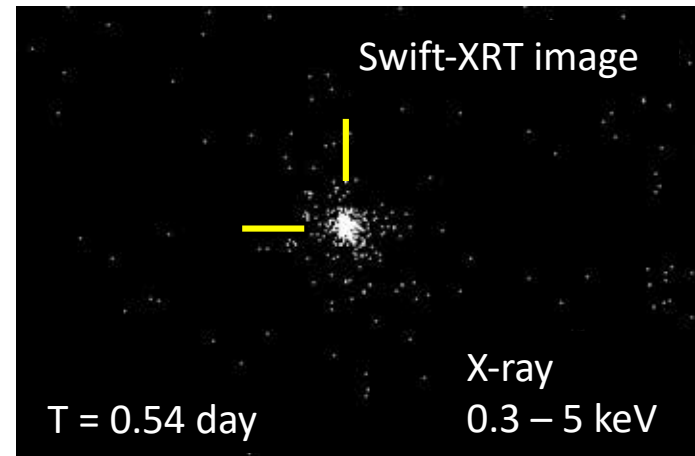
- Swift follow-up lead to identification to a star near SMC (Be star at 60 kpc)

Morii et al. 2013

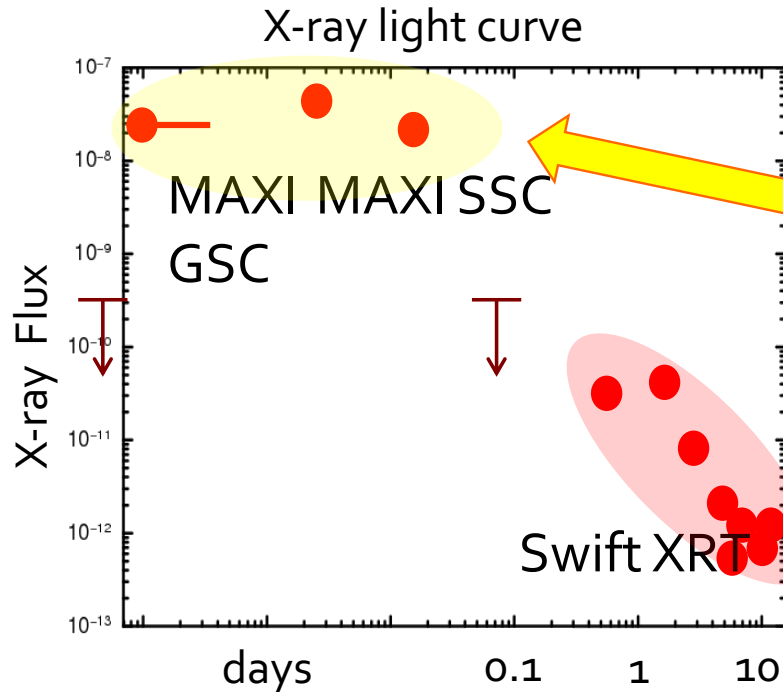
# Detection and Follow-up



## Swift follow-up observation



# MAXI J0158-744



- Duration  $\approx$  hour
  - ( $1300 \text{ s} < \Delta T < 1.1 \times 10^4 \text{ s}$ )
- Extremely luminous
  - $10^{40} \text{ erg / s}$
  - x100 solar mass Eddington luminosity
- supersoft X-ray source at late phase
  - white dwarf
  - classical/recurrent nova?
    - but  $\times 10^4$  more luminous than known nova X-ray emission
      - (shocked ISM? Li et al. 2012)

Morii et al. 2013

# Nova (nuclear fusion) explosion

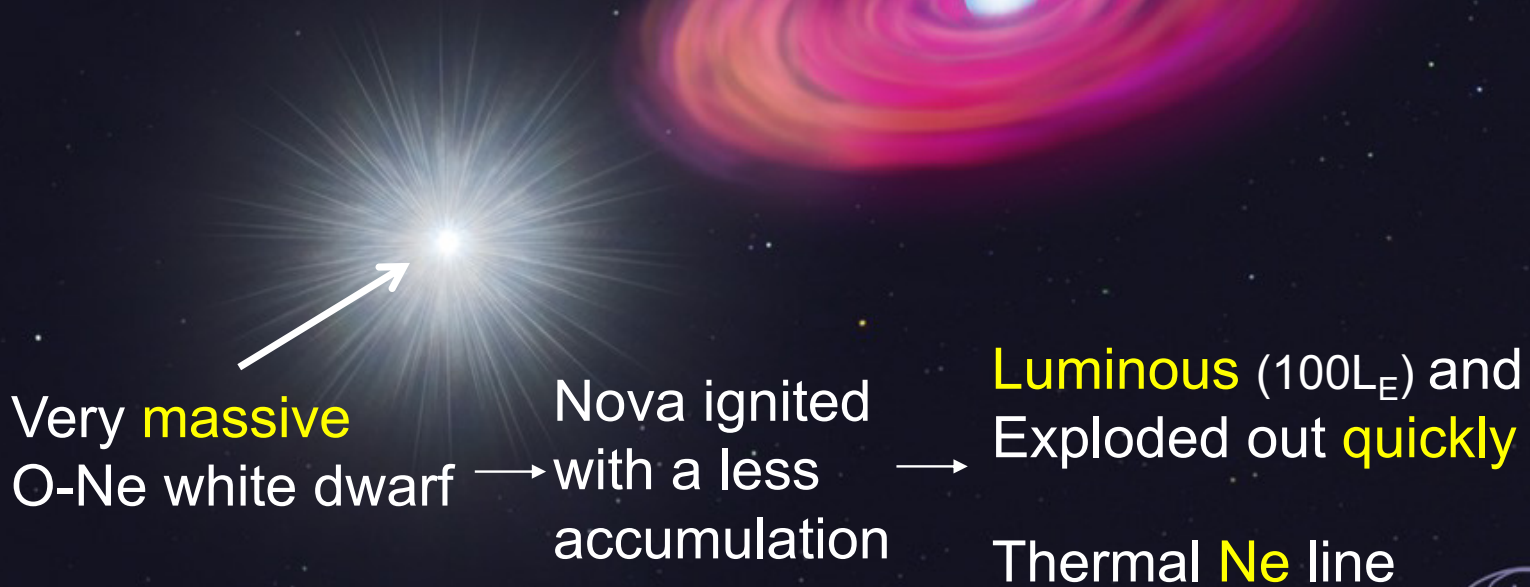
Morii et al. (2013)

rare

## WD-Be binary system (MAXI J0158-744)

Be star

Circumstellar disk



*Takuya Ohkawa*

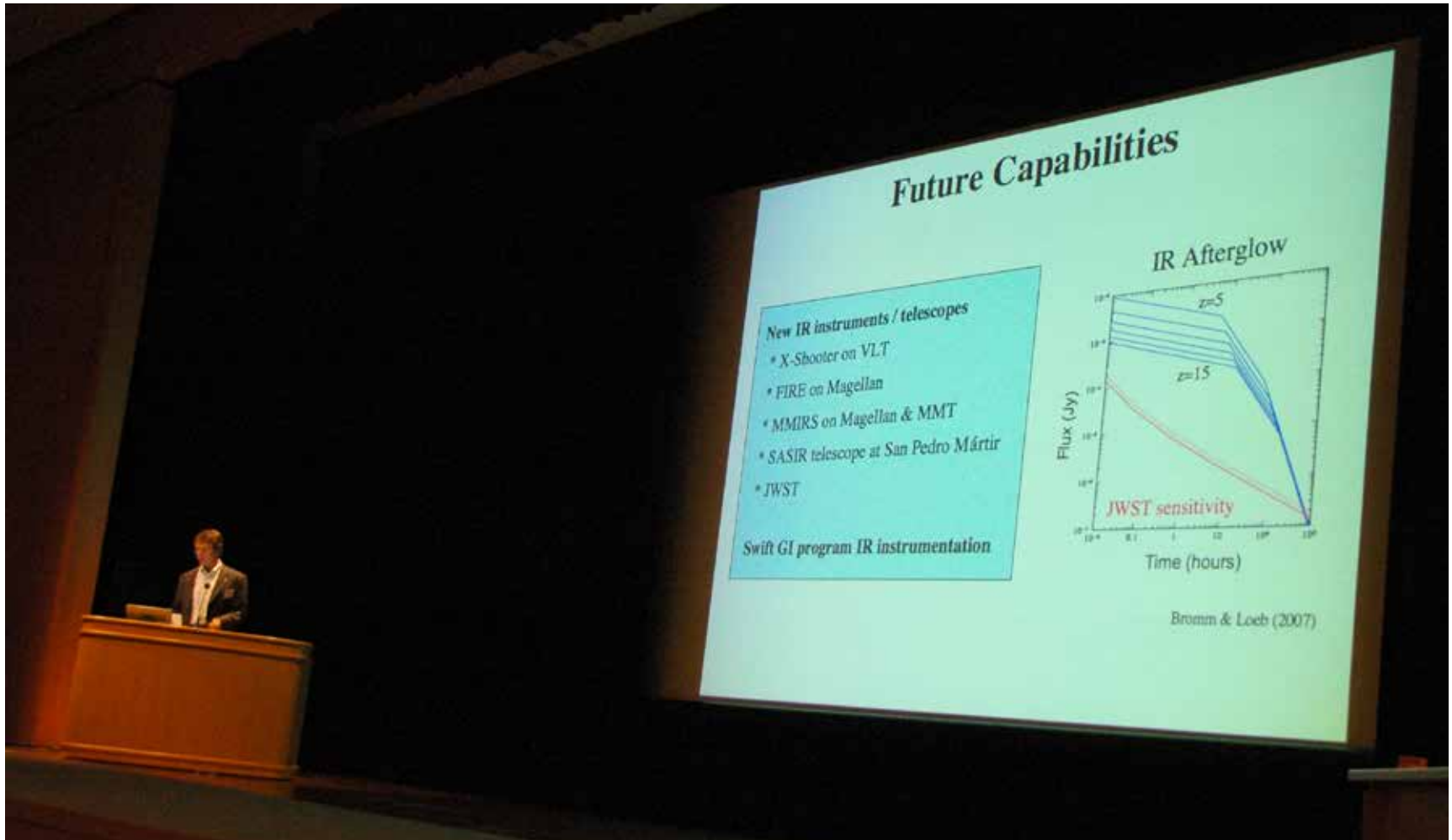
Credit: Takuya Ohkawa



MAXI would not have been so successful  
without the Swift collaboration

Thank you, Neil,  
thank you, the Swift Team

# Neil in Kyoto at “Deciphering Ancient Universe with GRBs”



Courtesy of Shigehiro Nagataki

Neil in Aspen with Ryo Yamazaki “Off-axis GRB” guy

