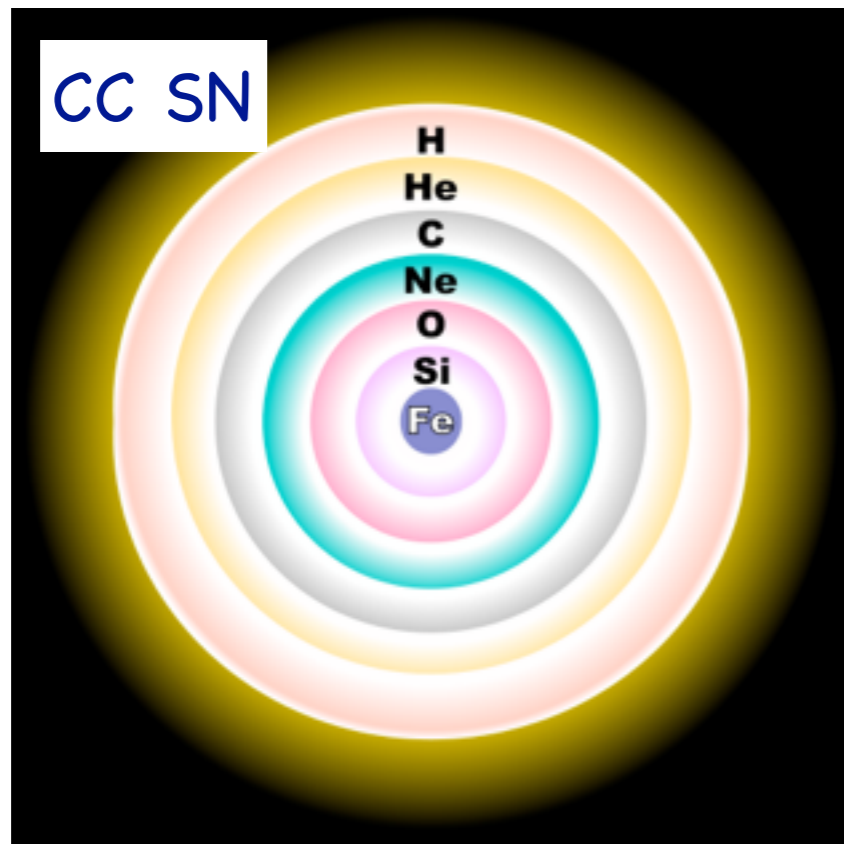
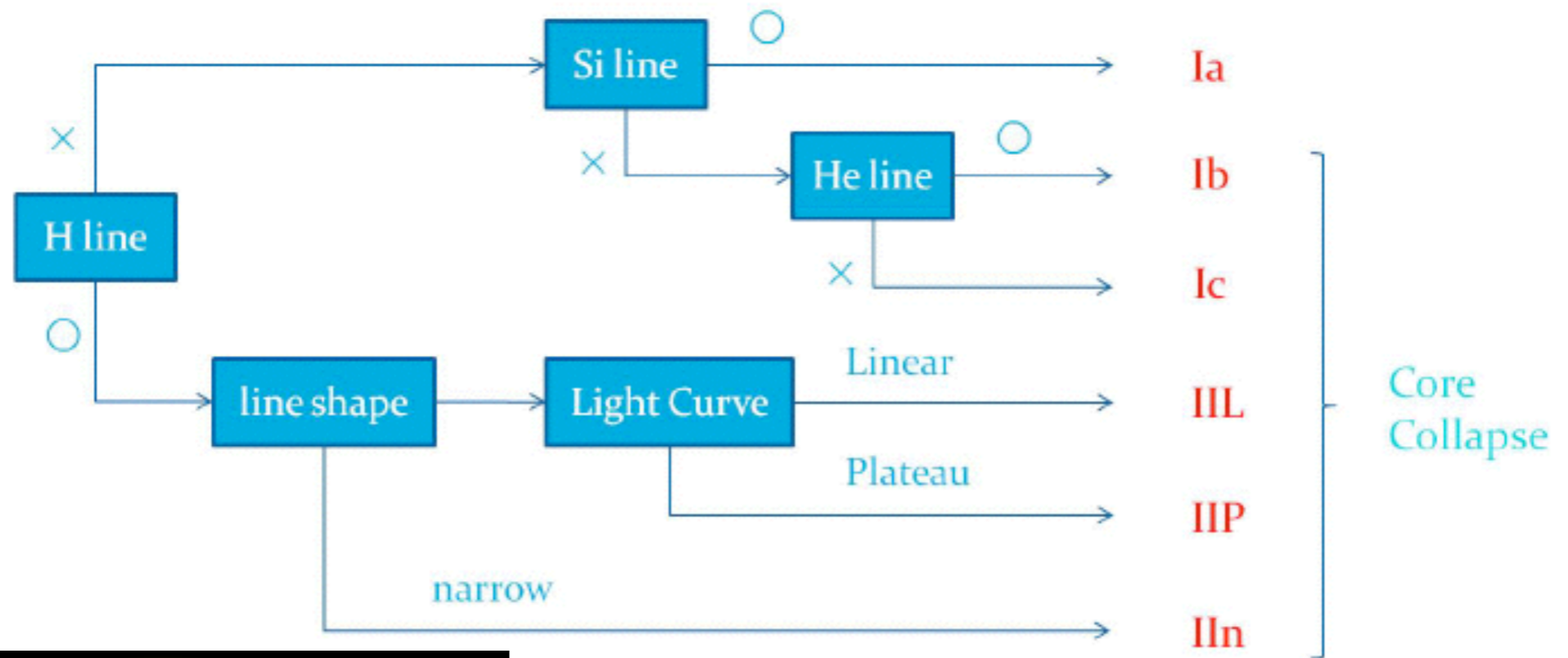


Kiso Supernova Survey (KISS)

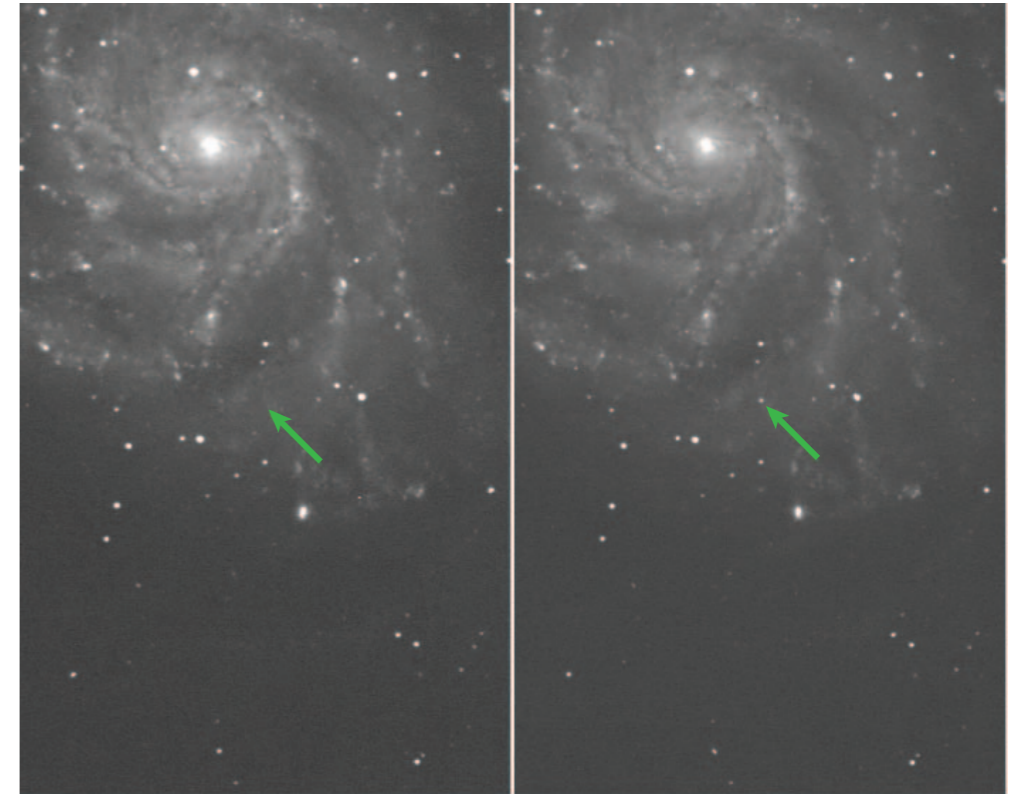
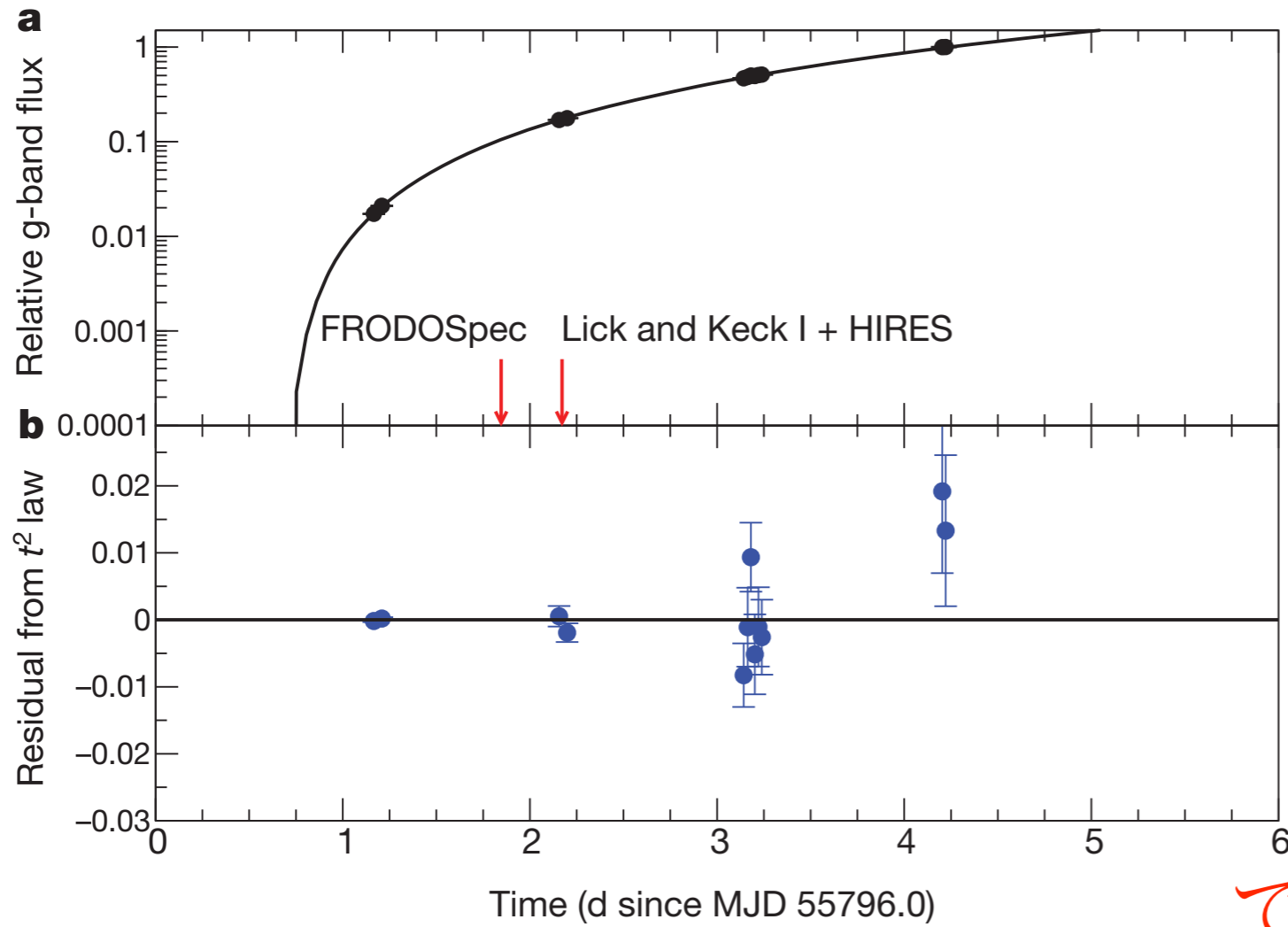
諸隈 智貴 (東京大学), 富永 望 (甲南大学),
田中 雅臣 (国立天文台), KISS project member

超新星 = 星の最期の大爆発

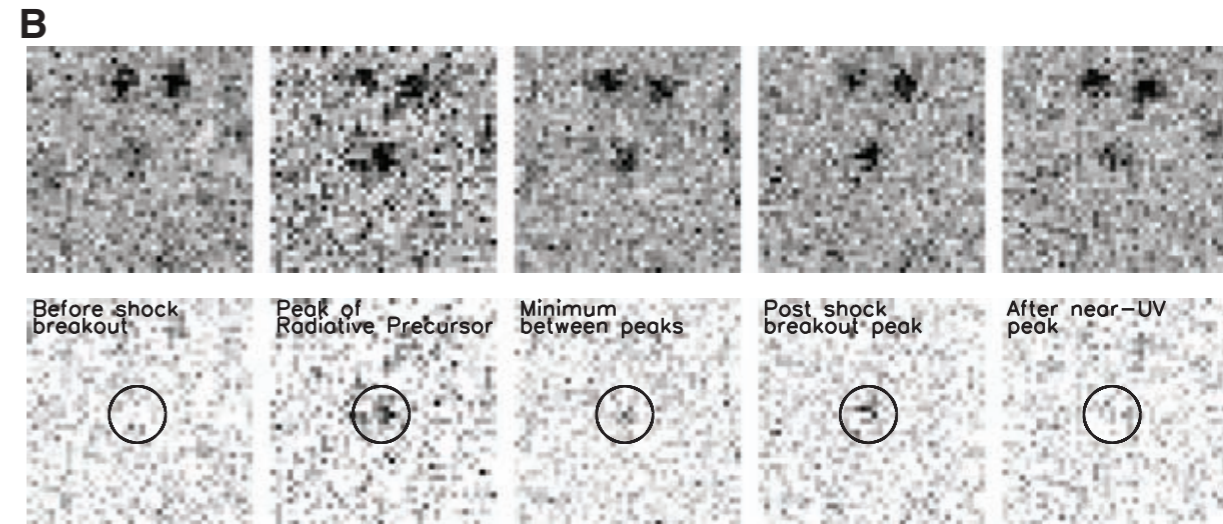
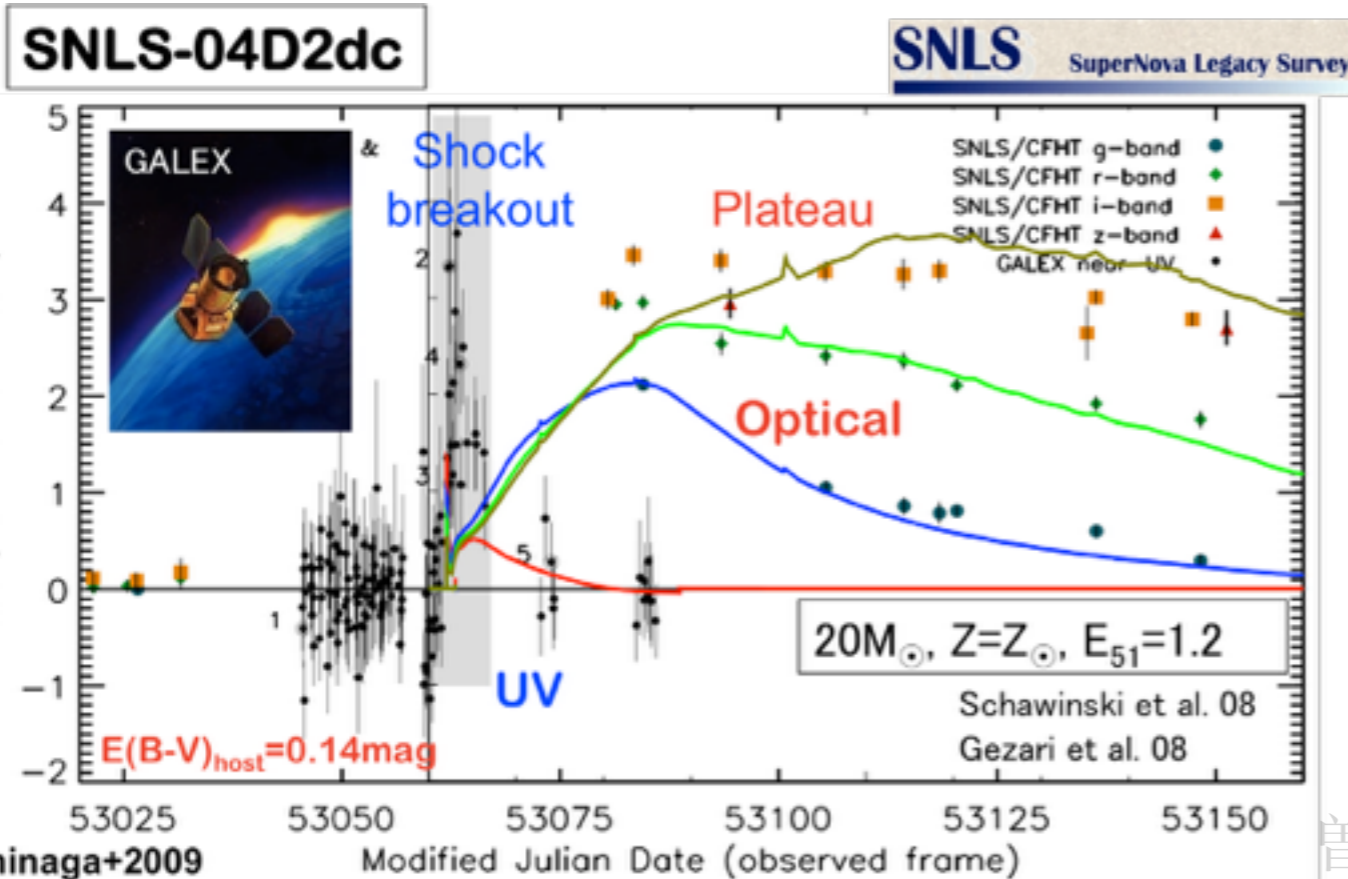
分類



SN 2011fe (Ia, Nugent+2011)



できる限り早期(<1日)の発見を

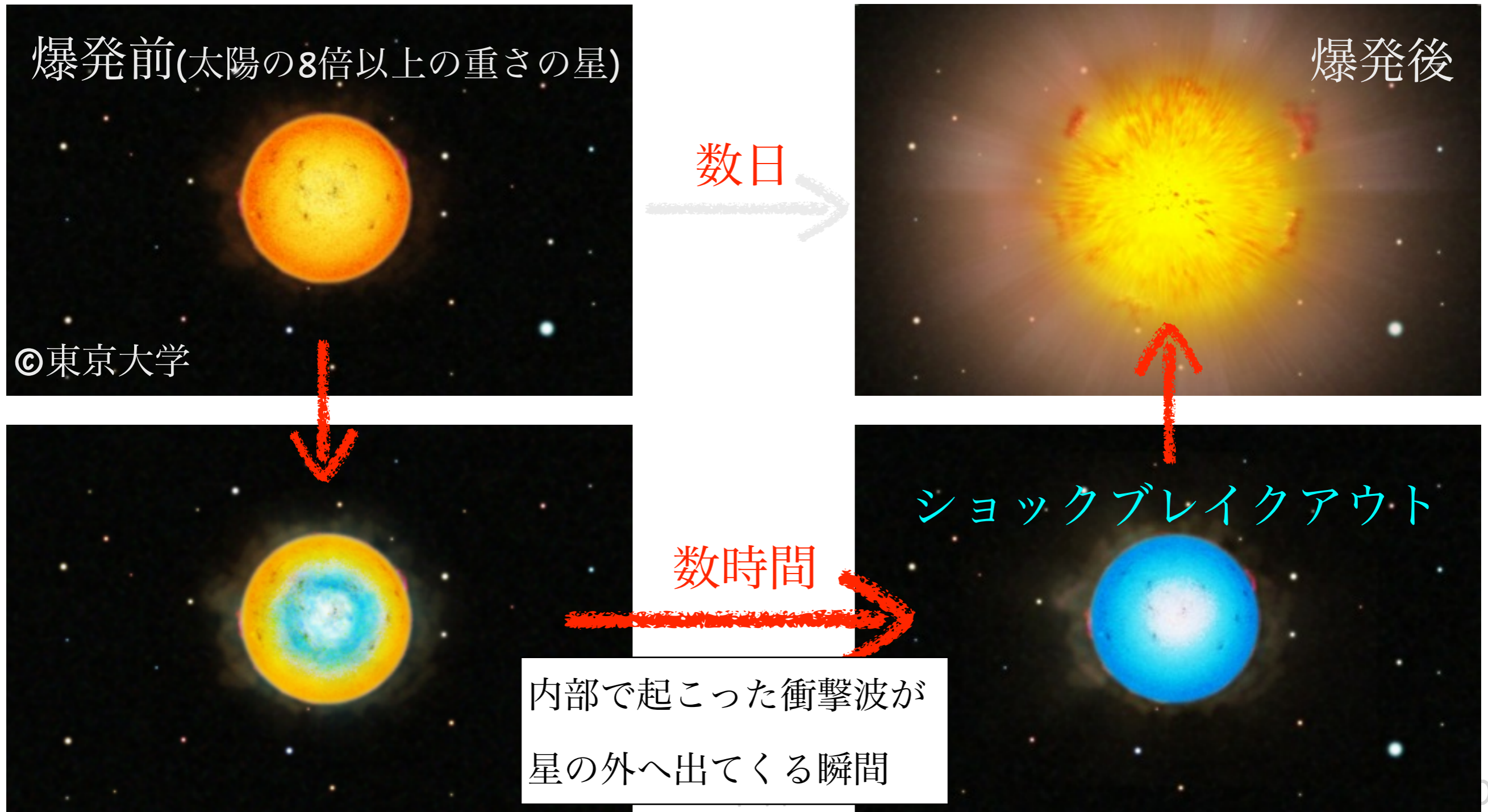


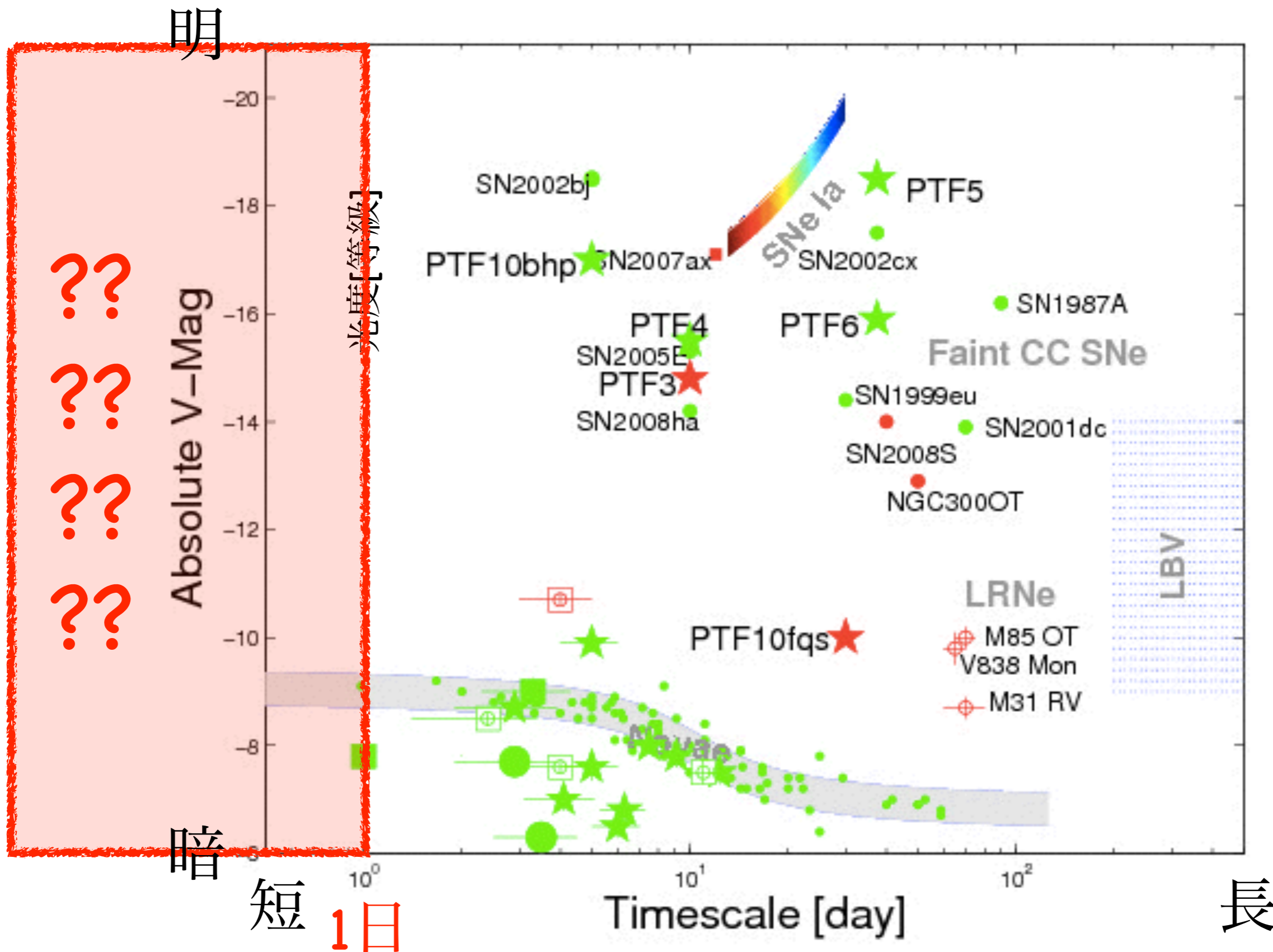
Schawinski+2008

Tominaga+2009

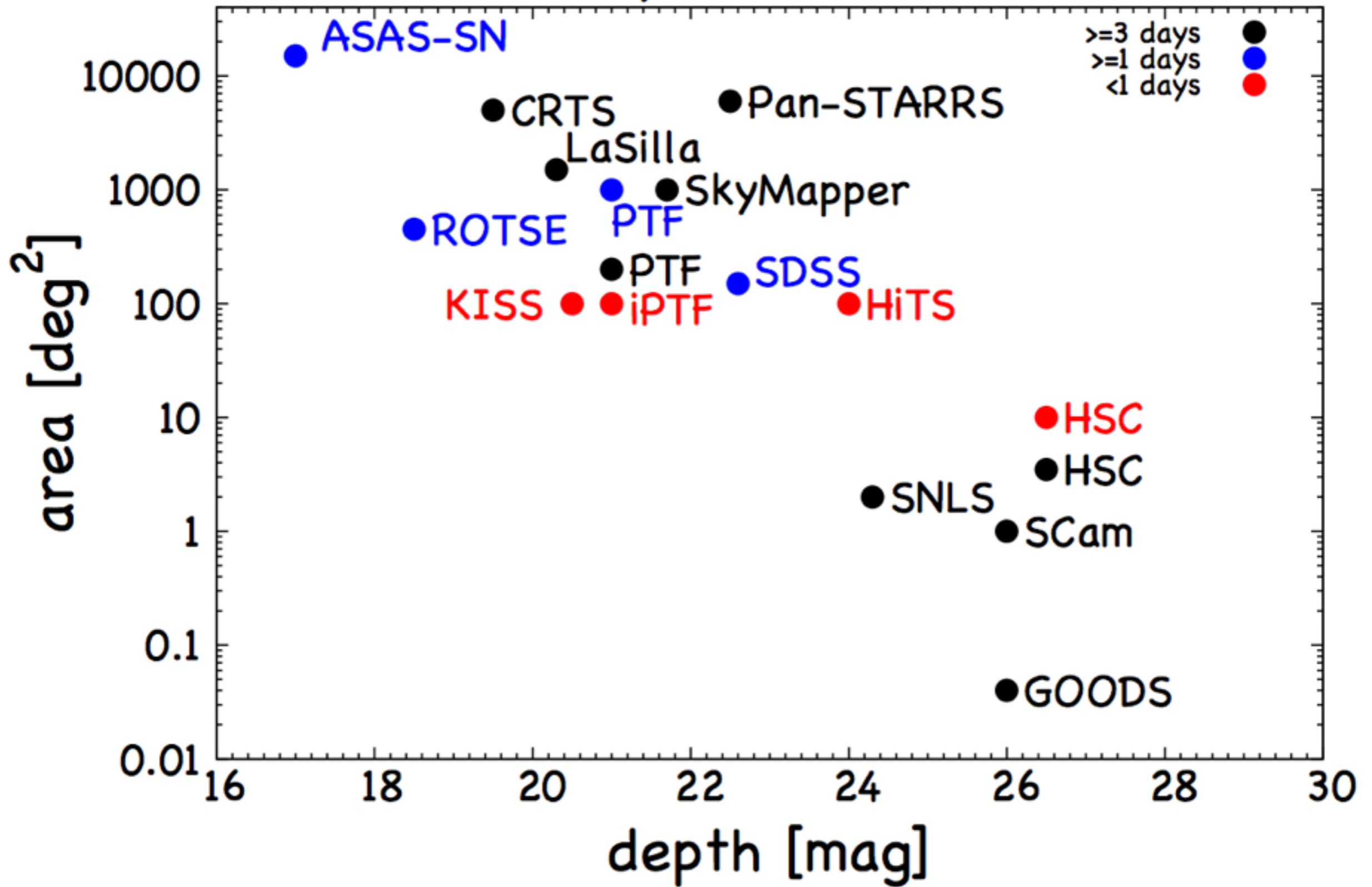
KISSプロジェクトの目的

shock breakout = 超新星の爆発の“ほぼ瞬間”をとらえる





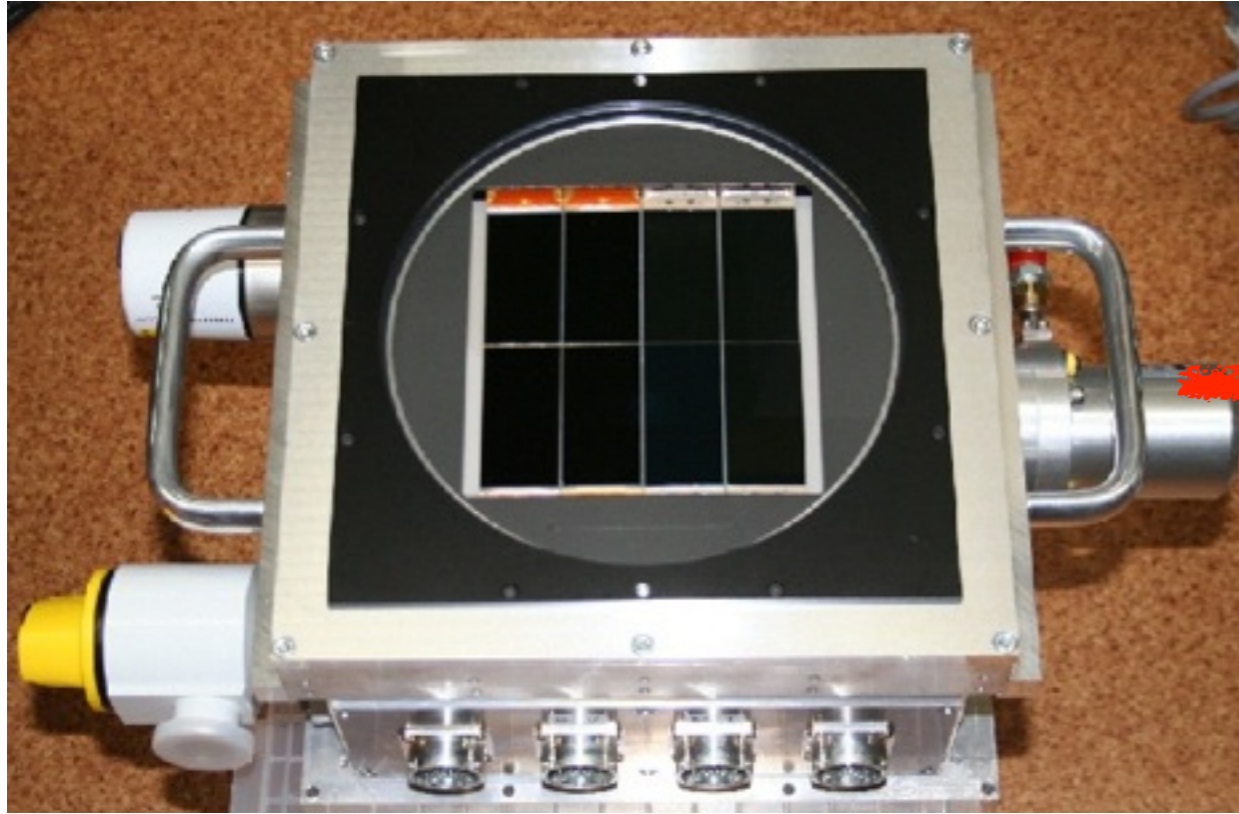
year 2015



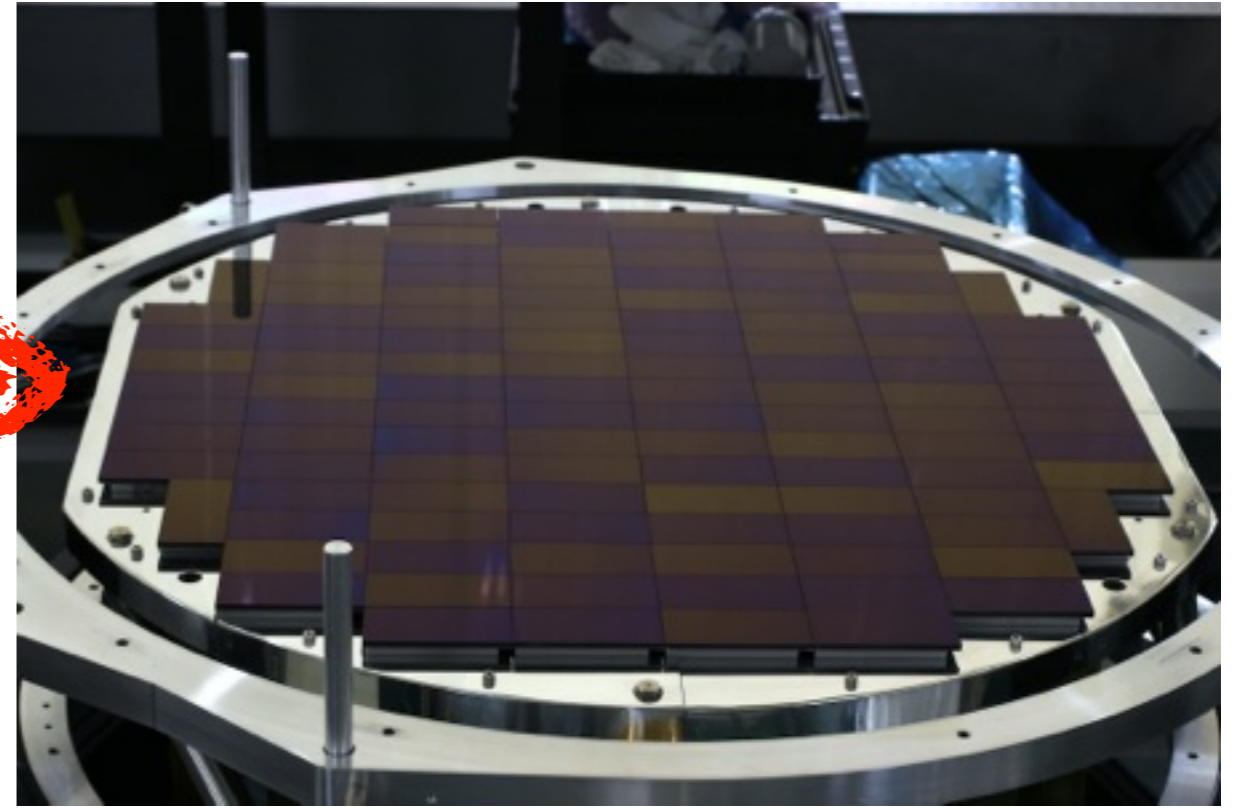
KISS Summary (TM+2014)

- Kiso Schmidt telescope + KWFC (4 deg²)
- g-band (4700 Å)
- 3-minute exposure (20–21 mag)
- 1-hour cadence
- 50–100 deg² / night
- 2012/4 – 2015/9 (3.5 yrs)
- ~100 nights / year
 - 422 nights in total
- spectroscopic follow-up w/ <4m telescopes
 - OAO188/KOOLS, Nayuta/LISS, Kanata/HOWPol
- 27 SNe & 1 dwarf nova identified

Searches for Shock Breakouts



Kiso/KWFC



Subaru/Hyper Suprime-Cam

KWFC観測(KISS)でshock breakoutの物理を検証・確立

最遠方の重力崩壊型超新星の観測手段

Tanaka+2016, Tominaga+ in prep.

KISS highlights

- Survey Strategy (TM+2014, PASJ) **published**
- peculiar radio-loud AGN, KISS14k (Tanaka+2014, ApJL) **published**



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Advance Access Publication Date: 2014 December 4



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Kiso Supernova Survey (KISS): Survey strategy

Tomoki MOROKUMA,^{1,*} Nozomu TOMINAGA,^{2,3} Masaomi TANAKA,⁴
Kensho MORI,⁵ Emiko MATSUMOTO,² Yuki KIKUCHI,¹ Takumi SHIBATA,²
Shigeyuki SAKO,¹ Tsutomu AOKI,⁶ Mamoru DOI,^{1,7} Naoto KOBAYASHI,¹
Hiroyuki MAEHARA,⁶ Noriyuki MATSUNAGA,⁸ Hiroyuki MITO,⁶
Takashi MIYATA,¹ Yoshikazu NAKADA,¹ Takao SOYANO,⁶ Ken'ichi TARUSAWA,⁶
Satoshi MIYAZAKI,⁴ Fumiaki NAKATA,⁹ Norio OKADA,⁴ Yuki SARUGAKU,¹⁰
Michael W. RICHMOND,¹¹ Hiroshi AKITAYA,¹² Greg ALDERING,¹³
Ko ARIMATSU,^{8,10} Carlos CONTRERAS,^{14,15} Takashi HORIUCHI,¹⁶
Eric Y. HSIAO,^{14,15} Ryosuke ITOH,⁵ Ikuru IWATA,⁹ Koji S. KAWABATA,¹²
Nobuyuki KAWAI,¹⁷ Yutaro KITAGAWA,¹ Mitsuru KOKUBO,¹ Daisuke KURODA,¹⁸
Paolo MAZZALI,^{19,20,21} Toru MISAWA,²² Yuki MORITANI,¹² Nidia MORRELL,¹⁴
Rina OKAMOTO,¹⁶ Nikolay PAVLYUK,²³ Mark M. PHILLIPS,¹⁴ Elena PIAN,^{24,25}
Devendra SAHU,²⁶ Yoshihiko SAITO,¹⁷ Kei SANO,^{8,10} Maximilian
D. STRITZINGER,¹⁵ Yutaro TACHIBANA,¹⁷ Francesco TADDIA,²⁷
Katsutoshi TAKAKI,⁵ Ken TATEUCHI,¹ Akihiko TOMITA,²⁸ Dmitry TSVETKOV,²³
Takahiro UI,⁵ Nobuharu UKITA,¹⁸ Yuji URATA,²⁹ Emma S. WALKER,³⁰
and Taketoshi YOSHII¹⁷

¹Institute of Astronomy, Graduate School of Science, The University of Tokyo, 2-21-1 Osawa, Mitaka, Tokyo 181-0015, Japan

²Department of Physics, Faculty of Science and Engineering, Konan University, 8-9-1 Okamoto, Kobe, Hyogo 658-8501, Japan

³Kavli Institute for the Physics and Mathematics of the Universe (WPI), The University of Tokyo, 5-1-5 Kashiwanoha, Kashiwa, Chiba 277-8583, Japan

⁴National Astronomical Observatory of Japan, 2-21-1 Osawa, Mitaka, Tokyo 181-8588, Japan

⁵Department of Physical Science, Hiroshima University, 1-3-1 Kagamiyama, Higashi-Hiroshima, Hiroshima 739-8526, Japan

⁶Kiso Observatory, Institute of Astronomy, Graduate School of Science, The University of Tokyo 10762-30, Mitake, Kiso-machi, Kiso-gun, Nagano 397-0101, Japan

⁷Research Center for the Early Universe, Graduate School of Science, The University of Tokyo, 7-3-1 Hongo, Bunkyo-ku, Tokyo 113-003, Japan

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DISCOVERY OF DRAMATIC OPTICAL VARIABILITY IN SDSS J1100+4421: A PECULIAR RADIO-LOUD NARROW-LINE SEYFERT 1 GALAXY?

MASAOMI TANAKA¹, TOMOKI MOROKUMA², RYOSUKE ITOH³, HIROSHI AKITAYA⁴, NOZOMU TOMINAGA^{5,6},
YOSHIHIKO SAITO⁷, ŁUKASZ STAWARZ^{8,9}, YASUYUKI T. TANAKA⁴, POSHAK GANDHI¹⁰, GAMAL ALI¹¹, TSUTOMU AOKI¹²,
CARLOS CONTRERAS¹³, MAMORU DOI², AHMAD ESSAM¹¹, GAMAL HAMED¹¹, ERIC Y. HSIAO¹³, IKURU IWATA¹⁴,
KOJI S. KAWABATA⁴, NOBUYUKI KAWAI⁷, YUKI KIKUCHI², NAOTO KOBAYASHI², DAISUKE KURODA¹⁵, HIROYUKI MAEHARA¹¹,
EMIKO MATSUMOTO⁵, PAOLO A. MAZZALI^{16,17,18}, TAKEO MINEZAKI², HIROYUKI MITO¹¹, TAKASHI MIYATA²,
SATOSHI MIYAZAKI¹, KENSHO MORI³, YUKI MORITANI⁴, KANA MOROKUMA-MATSUI¹⁹, NIDIA MORRELL¹³, TOHRU NAGAO²⁰,
YOSHIKAZU NAKADA², FUMIYUKI NAKATA¹⁴, CHINAMI NOMA²¹, KEN OHSUGA¹, NORIO OKADA¹, MARK M. PHILLIPS¹³,
ELENA PIAN^{22,23}, MICHAEL W. RICHMOND²⁴, DEVENDRA SAHU²⁵, SHIGEYUKI SAKO², YUKI SARUGAKU⁸, TAKUMI SHIBATA⁵,
TAKAO SOYANO¹¹, MAXIMILIAN D. STRITZINGER²⁶, YUTARO TACHIBANA⁷, FRANCESCO TADDIA²⁷, KATSUTOSHI TAKAKI³,
ALI TAKEY¹¹, KEN'ICHI TARUSAWA¹², TAKAHIRO UI³, NOBUHARU UKITA¹⁵, YUJI URATA²⁸, EMMA S. WALKER²⁹,
AND TAKETOSHI YOSHII⁷

¹National Astronomical Observatory of Japan, Mitaka, Tokyo 181-8588, Japan; masaomi.tanaka@nao.ac.jp

²Institute of Astronomy, School of Science, University of Tokyo, Mitaka, Tokyo 181-0015, Japan

³Department of Physical Sciences, Hiroshima University, Higashi-Hiroshima, Hiroshima 739-8526, Japan

⁴Hiroshima Astrophysical Science Center, Hiroshima University, Higashi-Hiroshima, Hiroshima 739-8526, Japan

⁵Department of Physics, Faculty of Science and Engineering, Konan University, Kobe, Hyogo 658-8501, Japan

⁶Kavli Institute for the Physics and Mathematics of the Universe (WPI), The University of Tokyo, Kashiwa, Chiba 277-8583, Japan

⁷Department of Physics, Tokyo Institute of Technology, Meguro-ku, Tokyo 152-8551, Japan

⁸Institute of Space and Astronautical Science, JAXA, Sagamihara, Kanagawa 252-0210, Japan

⁹Astronomical Observatory, Jagiellonian University, ul. Orla 171, 30-344 Krakow, Poland

¹⁰Department of Physics, Durham University, Durham DH1 1TA, UK

¹¹National Research Institute of Astronomy and Geophysics, Helwan, Cairo, Egypt

¹²Kiso Observatory, Institute of Astronomy, School of Science, The University of Tokyo, Kiso, Nagano 397-0101, Japan

¹³Carnegie Observatories, Las Campanas Observatory, Colina El Pino, Casilla 601, Chile

¹⁴Subaru Telescope, National Astronomical Observatory of Japan, Hilo, HI 96720, USA

¹⁵Okayama Astrophysical Observatory, National Astronomical Observatory of Japan, Asakuchi, Okayama 719-0232, Japan

¹⁶Astrophysics Research Institute, Liverpool John Moores University, IC2, Liverpool Science Park, 146 Brownlow Hill, Liverpool L3 5RF, UK

¹⁷Istituto Nazionale di Astrofisica-OAPD, vicolo dell'Osservatorio 5, I-35122 Padova, Italy

¹⁸Max-Planck-Institut für Astrophysik, Karl-Schwarzschild-Strasse 1, D-85748 Garching, Germany

¹⁹Nobeyama Radio Observatory, Nobeyama, Minamimaki, Minamimaki, Nagano 384-1305, Japan

²⁰Research Center for Space and Cosmic Evolution, Ehime University, Bunkyo-cho, Matsuyama 790-8577, Japan

²¹Astronomical Institute, Tohoku University, Aramaki, Aoba-ku, Sendai 980-8578, Japan

²²Scuola Normale Superiore di Pisa, Piazza dei Cavalieri 7, I-56126 Pisa, Italy

²³INAF-Istituto di Astrofisica Spaziale e Fisica Cosmica, Via P. Gobetti 101, I-40129 Bologna, Italy

²⁴Department of Physics, Rochester Institute of Technology, 85 Lomb Memorial Drive, Rochester, NY 14623-5603, USA

²⁵Indian Institute of Astrophysics, Koramangala, Bangalore 560 034, India

²⁶Department of Physics and Astronomy, Aarhus University, Ny Munkegade, DK-8000 Aarhus C, Denmark

²⁷The Oskar Klein Centre, Department of Astronomy, Stockholm University, AlbaNova, SE-10691 Stockholm, Sweden

²⁸Institute of Astronomy, National Central University, Chung-Li 32054, Taiwan

²⁹Department of Physics, Yale University, New Haven, CT 06520-8120, USA

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ABSTRACT

We present our discovery of dramatic variability in SDSS J1100+4421 by the high-cadence transient survey Kiso Supernova Survey. The source brightened in the optical by at least a factor of three within about half a day. Spectroscopic observations suggest that this object is likely a narrow-line Seyfert 1 galaxy (NLS1) at $z = 0.840$, however, with unusually strong narrow emission lines. The estimated black hole mass of $\sim 10^7 M_{\odot}$ implies bolometric nuclear luminosity close to the Eddington limit. SDSS J1100+4421 is also extremely radio-

KISS highlights

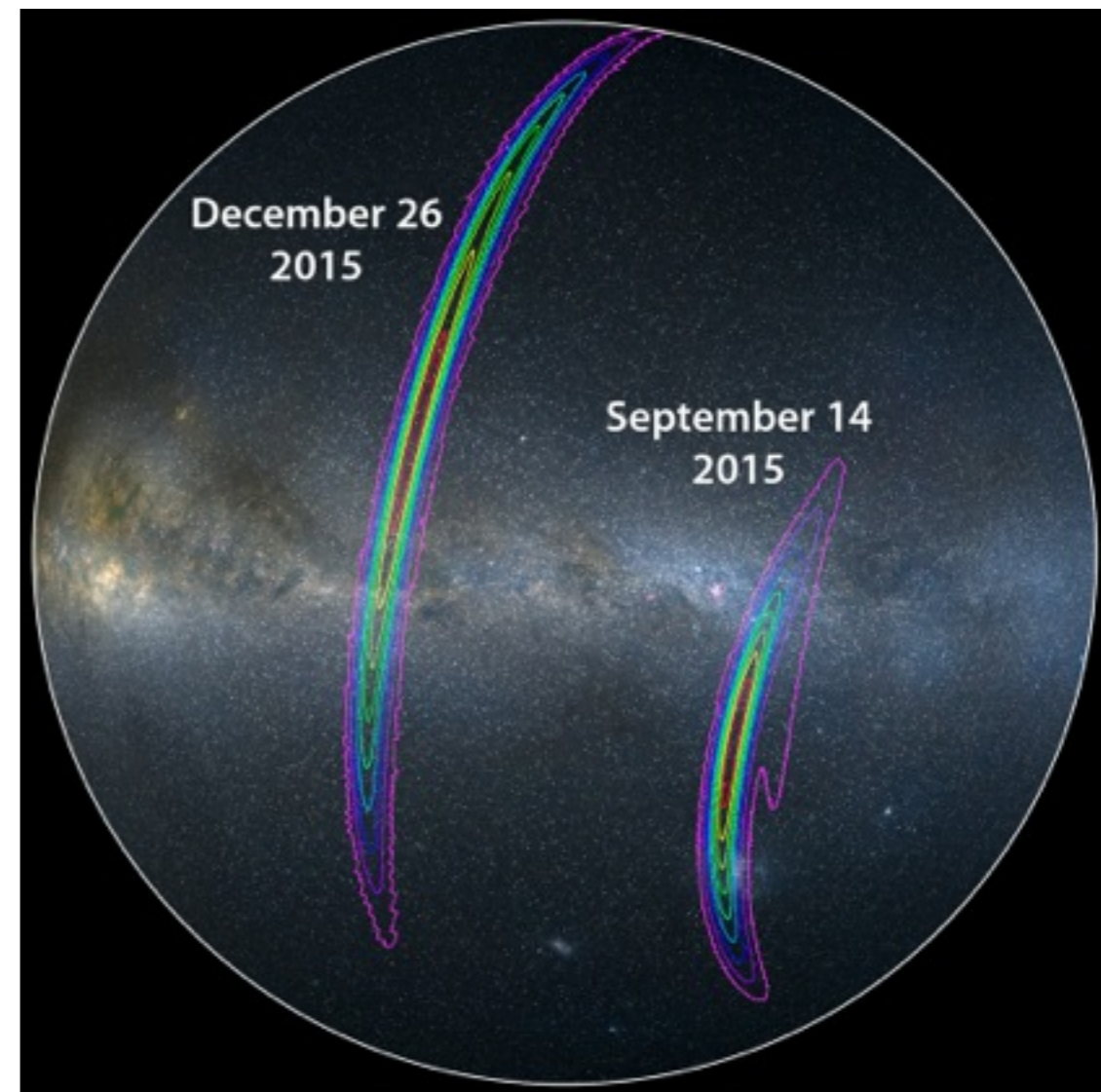
- Survey Strategy (TM+2014, PASJ) **published**
- peculiar radio-loud AGN, KISS14k (Tanaka+2014, ApJL) **published**
- KISS14k OISTER monitoring (TM+) **almost ready to submit**
- Type Ibn SN, KISS14z/SN 2014bk (TM+) **in prep.**
- KISS14k EVN(+VERA) observations (Gabanyi+) **in prep.**
- Early detections of Type Ia SNe (Jiang+) **in prep.**
- peculiar Type IIn SN (Kokubo+) **in prep.**

KISS Summary

- 2011年のシュミットシンポで議論開始
- 観測: 2012/4–2015/9 (3.5年)
- 解析自動化
 - 一次処理、引き算、超新星候補天体検出・チェック
 - “KISS w/ KWFC”以外にも
 - 超新星サーベイ w/ Subaru/HSC
 - 重力波電磁波対応天体サーベイ w/ KWFC, HSC (see Masaomi’s talk)
 - MAXI transient可視光対応天体サーベイ w/ KWFC
 - 超新星サーベイ w/ Tomo-e Gozen (see Nozomu’s talk)
- shock breakout candidate: 0

重力波電磁波対応天体フォローアップ観測

- 田中くん講演参照
- これまでに2イベント検出
 - GW150914: BH-BH merger, 距離410 Mpc
 - GW151226: BH-BH merger, 距離440 Mpc
- 位置決定精度が悪い



重力波電磁波対応天体 フォローアップ観測

2016/06/15 GW151226発表

O1終了

2016/02/11 GW150914発表

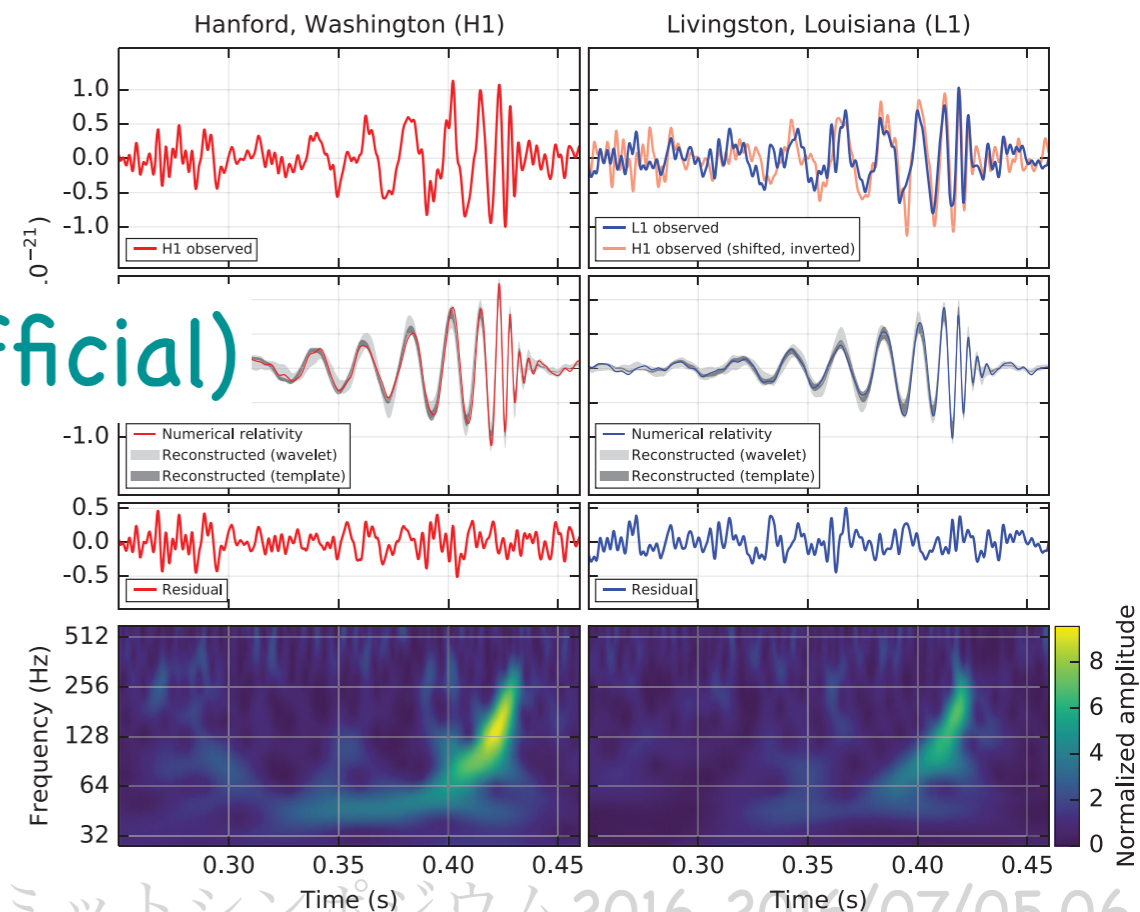
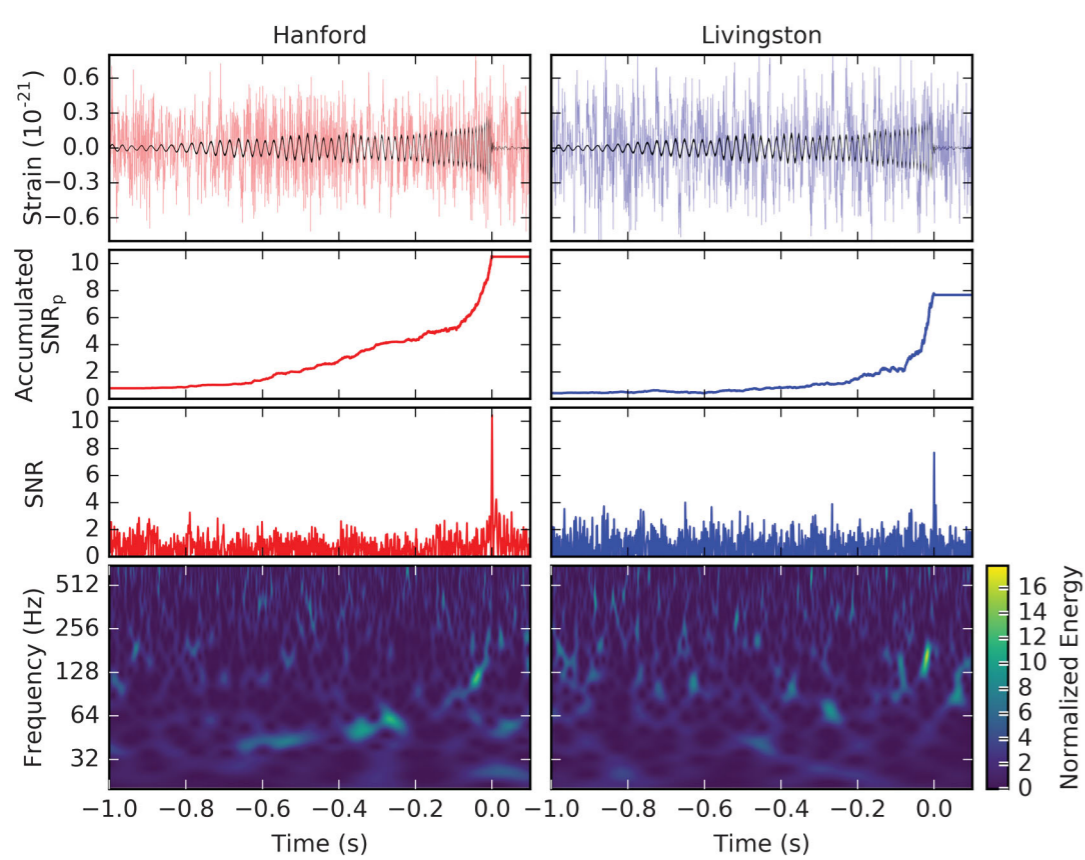
2016/12/28

GW151226アラート

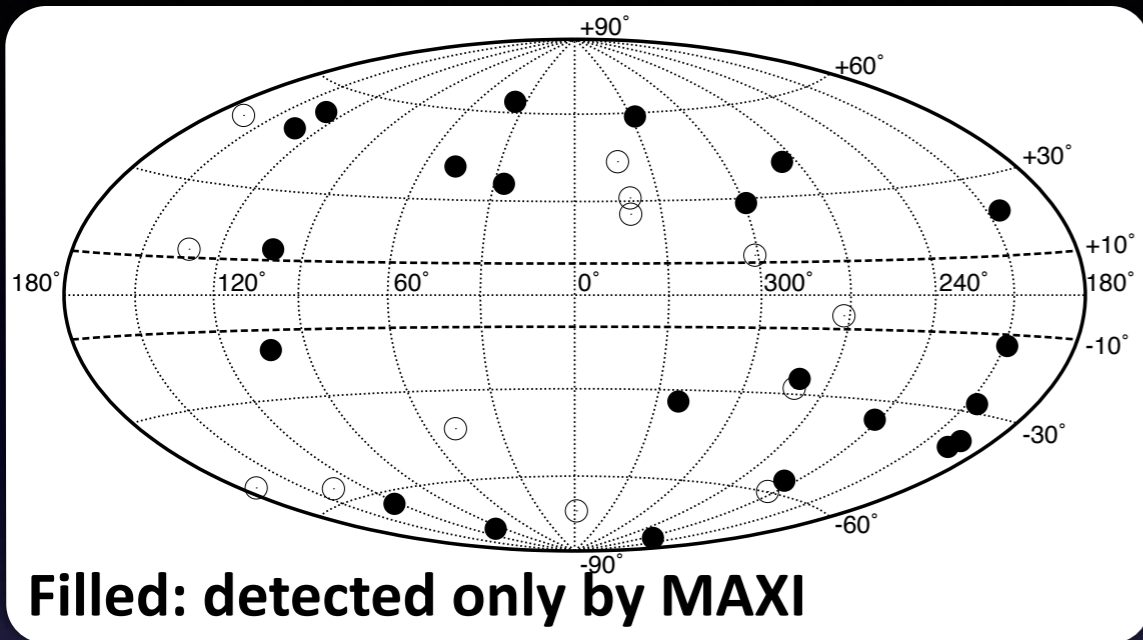
2015/09/18 O1開始(official)

2015/09/16

GW150914アラート

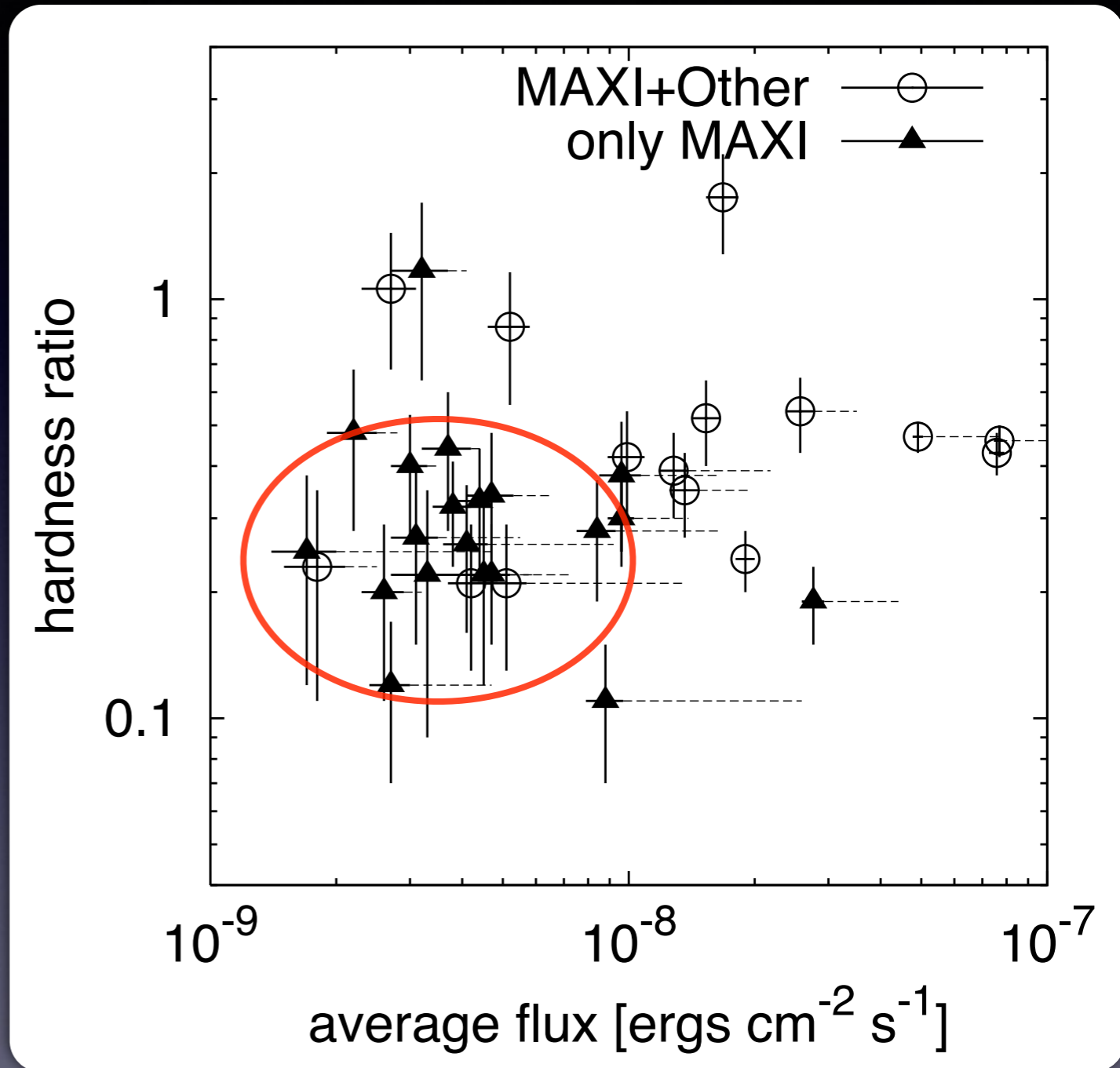


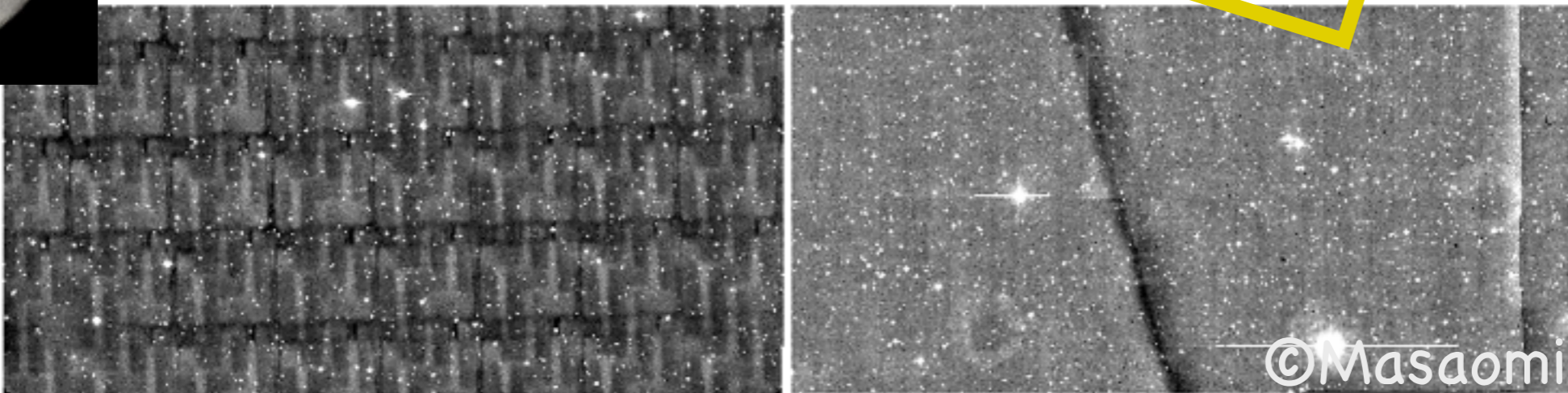
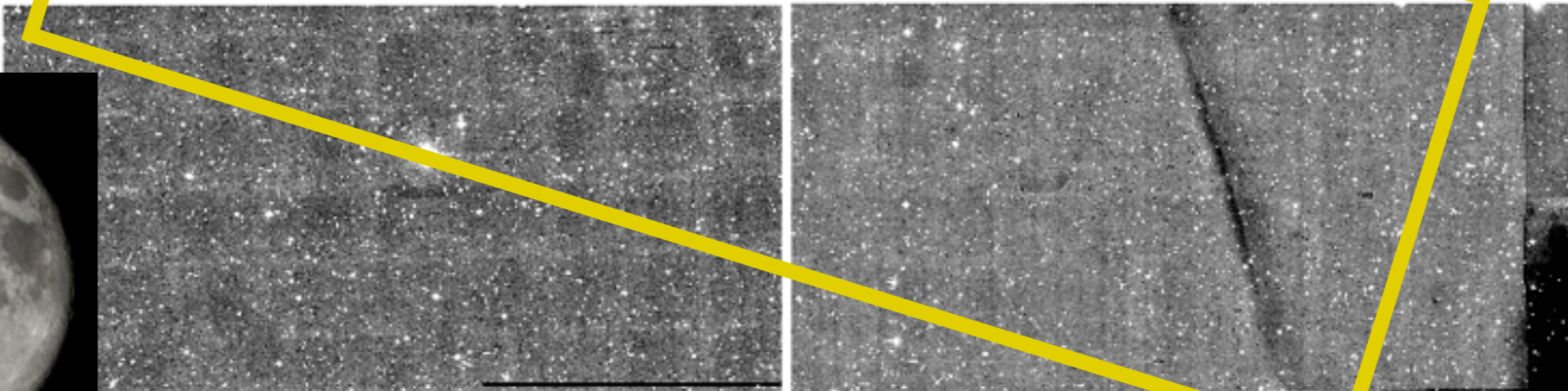
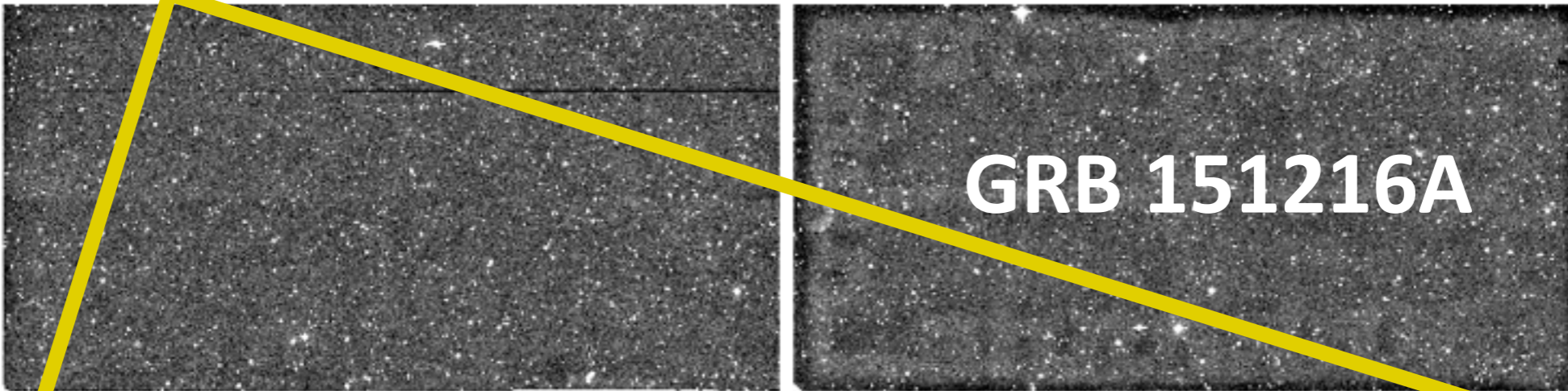
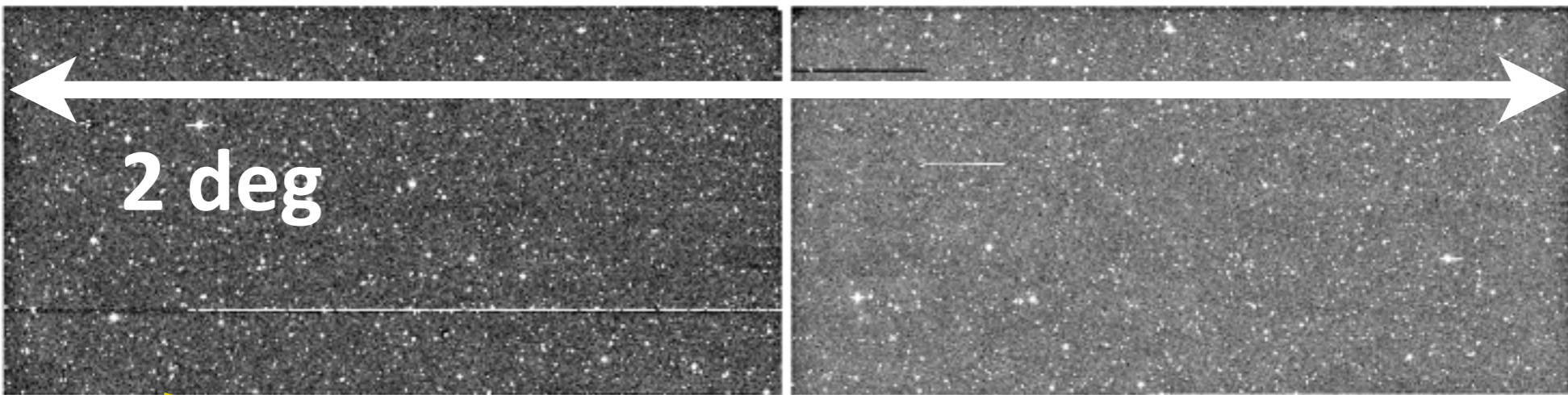
MAXI X-ray sources



- Isotropic
- Low flux
- Soft spectrum

=> X-ray flash? (XRF)





PI: Akihiro Suzuki (Kyoto)

GRB	Swift/XRT	Swift/UVOT	Kiso	Other
151205C	No det. (4.7 hr)	-	No det. (0.6-25 days)	-
151212A	Detected (2.4 hr)	No det.	-	GROND 2.2m (23 mag@13.5 hr)
151216A	-	-	No det. (1-14 days)	-
160101A	2×10 (4.5 hr)	~ 18 mag@4 hr	-	Fermi GBM, CALET, Konus
160102A	$1-3 \times 10$ (3.9 hr)	-	No det. (1-3 days)	Konus-wind
160104B	-	-	Analyzing (1-18 days)	Konus-wind
160206A	1×10 (14 hr)	No det. (14 hr)	No det. (10 hr)	-

flux ($\text{erg s}^{-1} \text{cm}^{-2}$)

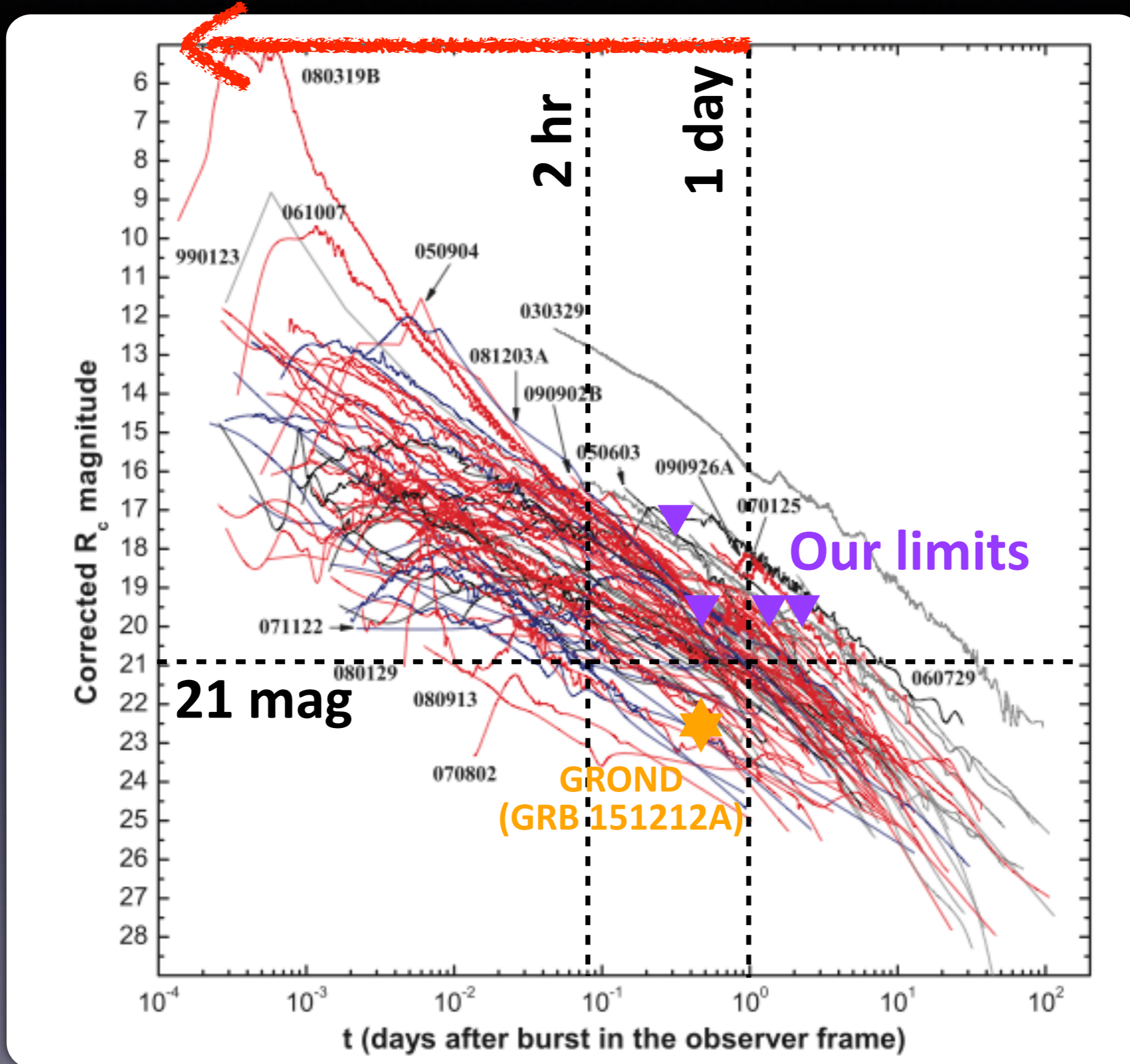
See also Negoro-san's talk

GRB 151205C: Kikuchi, MT, and Tomo-e team , 2015, GCN Circ, 18677

GRB 160206A: Morokuma, Tominaga, MT+, 2016, GCN Circ, 19008

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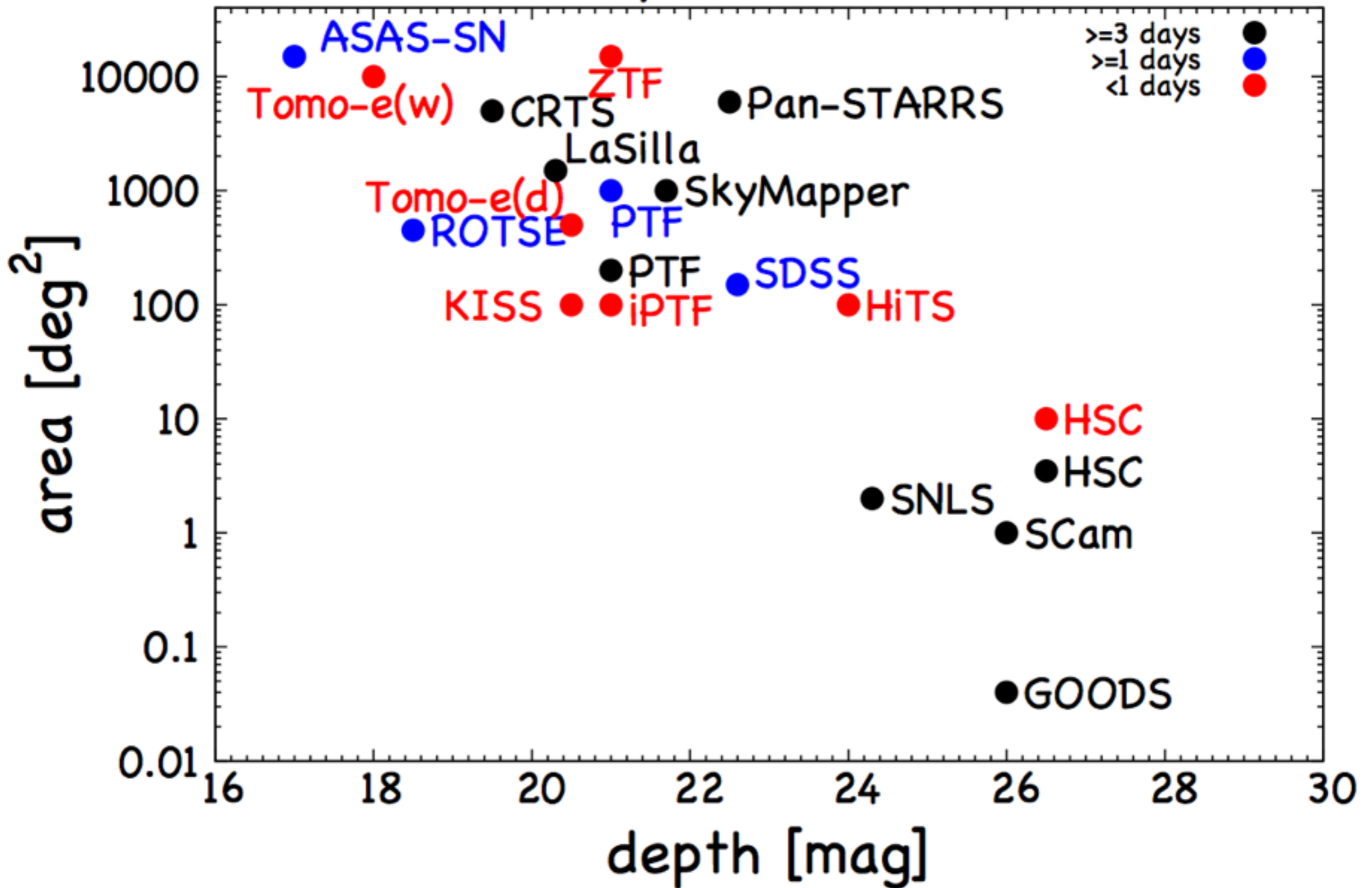
Tomo-*e*での全天サーベイで自然と??



Tomo-e Gozen時代の超新星サーベイ

- より高い効率での広視野観測
 - 広視野化: $4 \text{ deg}^2 \Rightarrow 20 \text{ deg}^2$
 - 短い読み出し時間: $\sim 0 \text{ sec}$
- サーベイ戦略($\sim 18 \text{ mag}$)
 - 全天 \times [1時間 cadence]
 - $3000 \text{ deg}^2 \times$ [15分 cadence]
- 大量 & 多様な超新星の“早期”発見
 - ~ 10 shock breakouts / 2 years
 - ~ 60 superluminous supernovae / 2 years
 - very nearby supernovae
- フォローアップ観測@日本&東アジア

year 2018



KISS Summary

- 2012/04より開始、2015/09で終了
- 1時間cadenceでの超高頻度超新星探査
- 見かけ等級 $g \sim 20$ mag, 距離 $d \sim < 200$ Mpc
 - ~ 1 shock breakout/3年
- KISSでより詳細な物理的理解、すばる/HSCで遠方星形成史etc.
- これまで27 SNe/dwarf novaの同定+報告
- データ即時解析、国内外follow-up collaboration体制の整備
- by-product: 超新星(Ibn型, IIn型), Ia型早期検出, radio-loud AGN
- KISSの財産で...
 - 重力波電磁波対応天体同定へ
 - MAXI transient可視光対応天体同定へ
 - Tomo-e Gozenでの全天超新星サーベイ
 - Subaru/HSCサーベイ