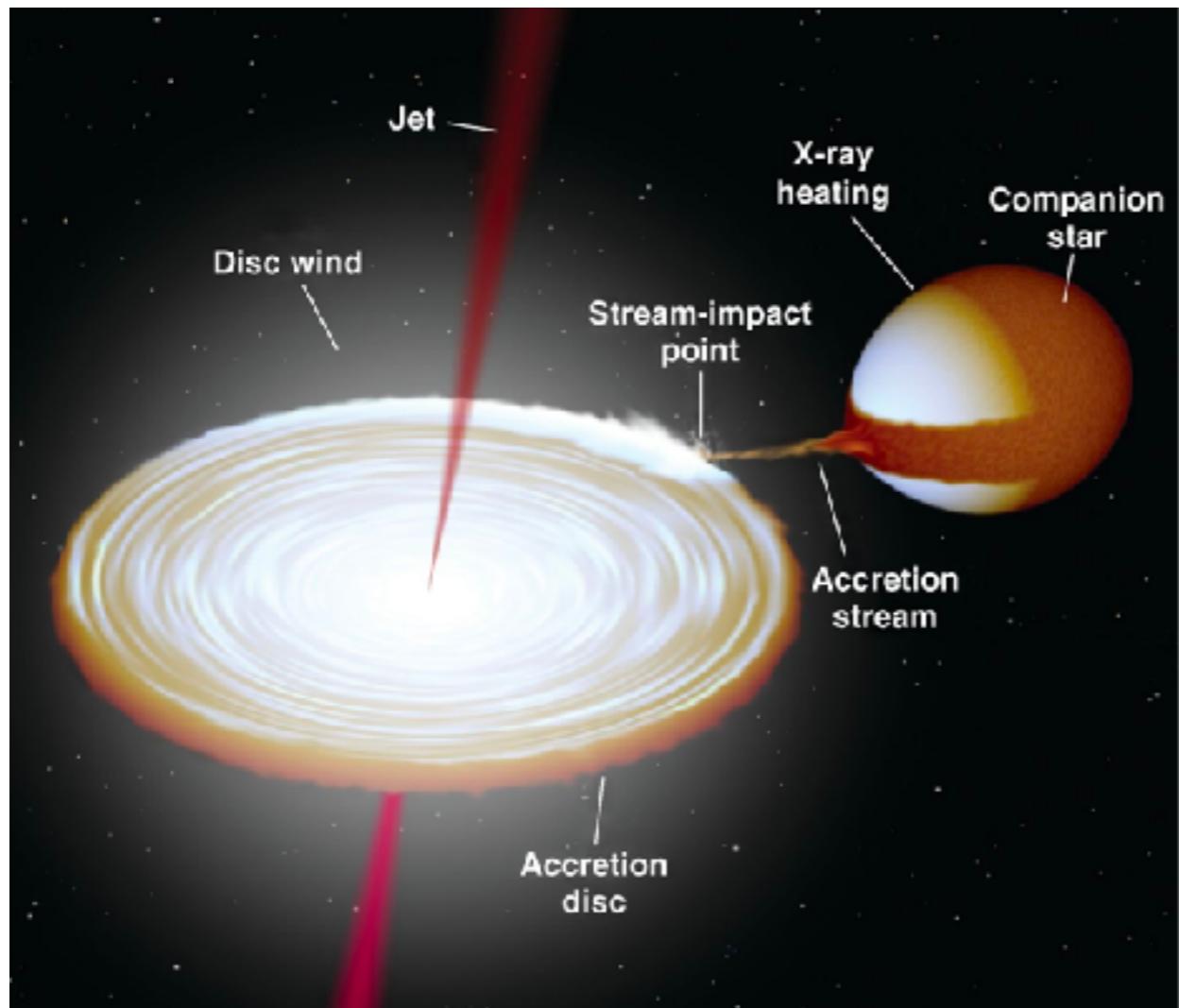


光赤外大学間連携
参加望遠鏡による
low mass X-ray binaryの追観測

村田勝寛(東工大)
東工大MITSuMEチーム

Low-mass X-ray binaries

Artist's impression of a X-ray binary

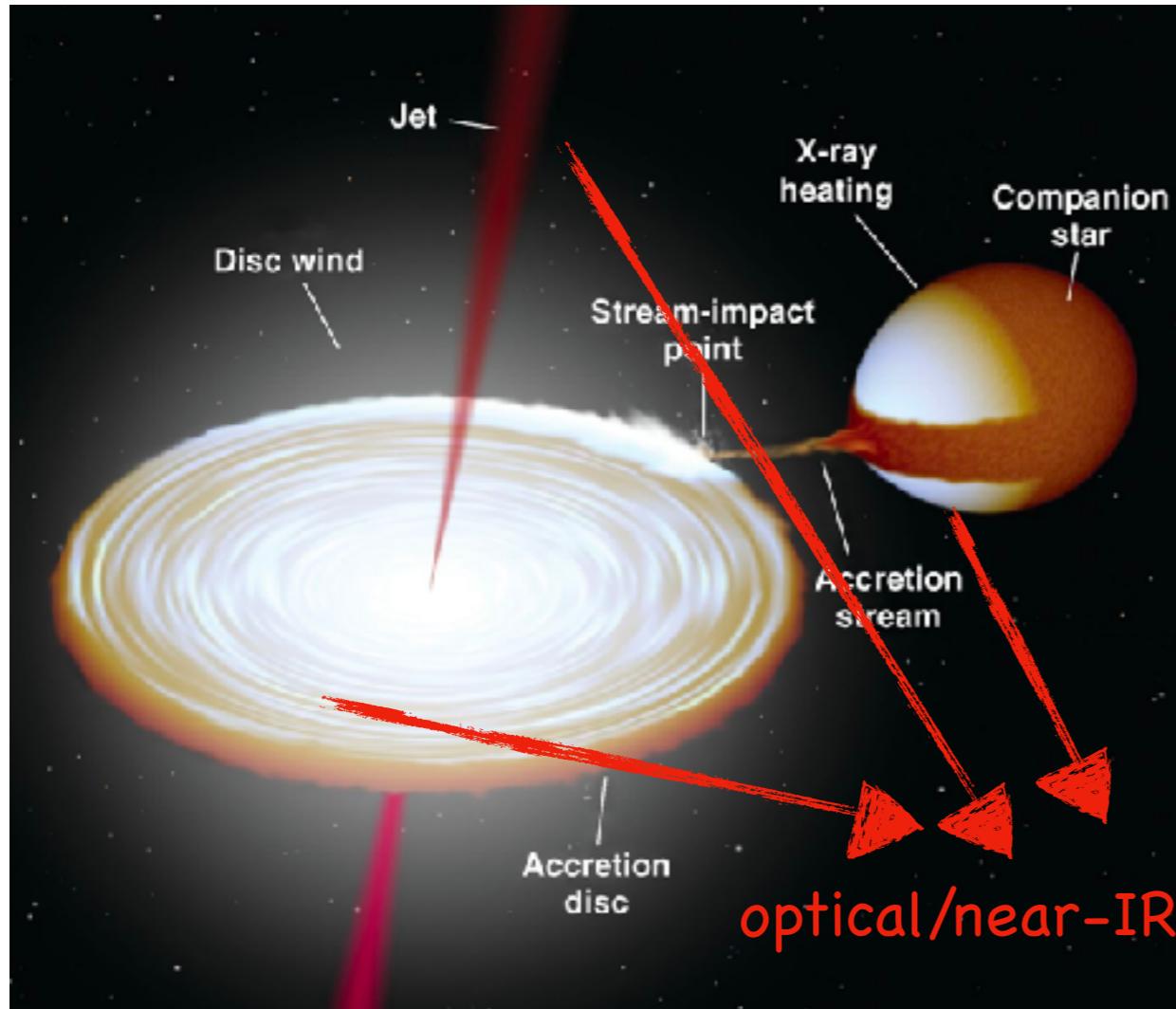


Credit: NASA/R. Hynes

- **X-ray binary (XRB):** system where one of the component is either a black hole or neutron star (compact star).
- **Low-mass X-ray binary (LMXB):** XRB whose companion star has a mass similar to or less than the Sun.

Optical/near-IR radiation from Low-mass X-ray binaries

Artist's impression of a X-ray binary



Credit: NASA/R. Hynes

- Thermal emission from the X-ray irradiated accretion disk and/or the companion
- Synchrotron emission from the jet

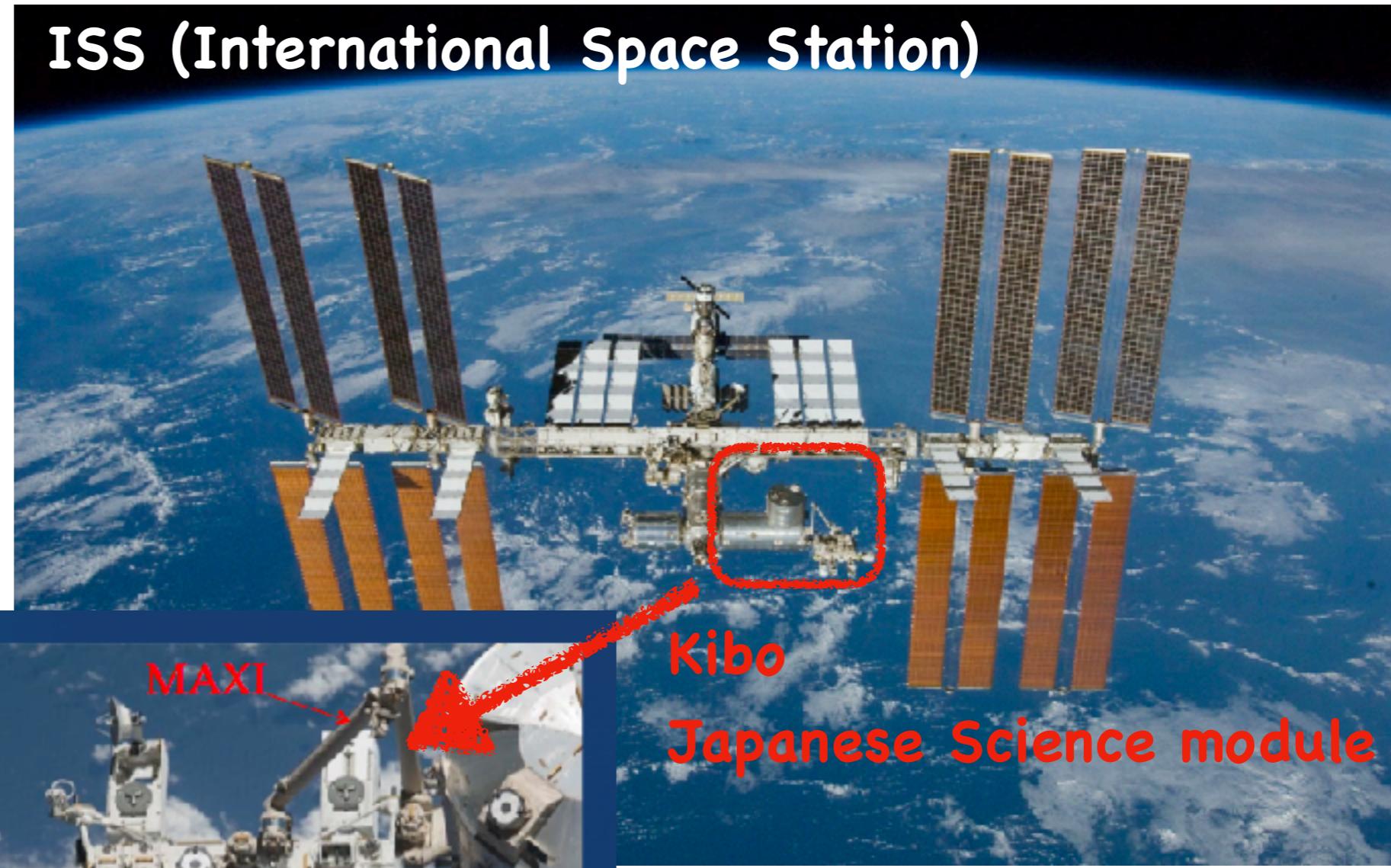
→

Optical/near-IR observation may provide information on accretion disk and radiation process.

This is motivation of our follow-up observation.

The low-mass X-ray binaries of our follow-up observations are mainly those discovered by MAXI (Monitor of All-sky X-ray Image).

ISS (International Space Station)



- Mission started 2009.
- a few - several new low-mass X-ray binaries / year

直近2年の観測

detection

- **MAXI J1535-571** (near-IR) <– IRSF
- **MAXI J1820+070** (optical & near-IR) <– OISTER ToO 3月
- Swift J1858.6-081 (optical & near-IR) <– OISTER ToO 先月
- MAXI J1727-203 (optical & near-IR) <– MITSuME、IRSF
- MAXI J1621-501 (near-IR, upper limit) <– IRSF ... 他

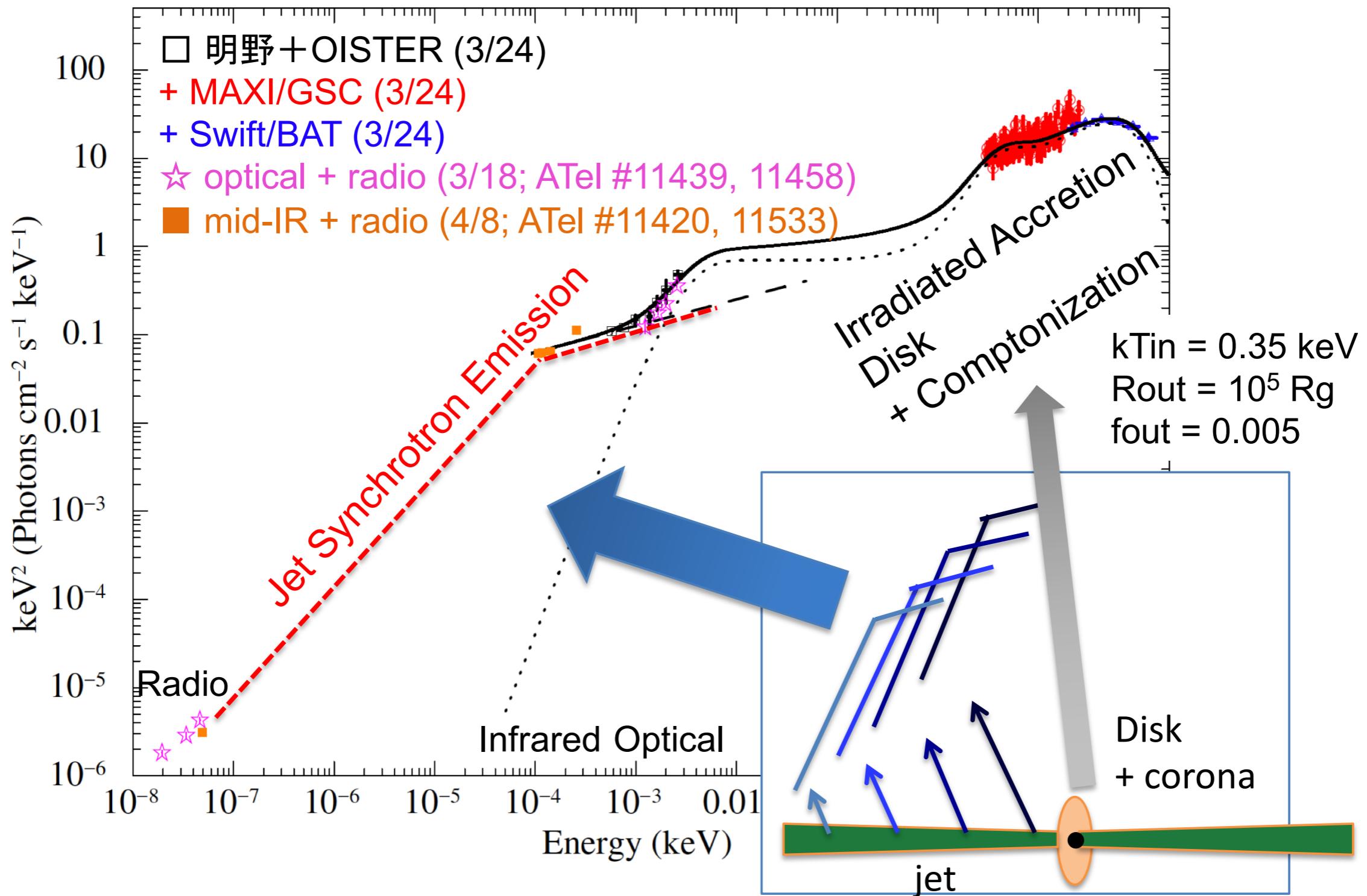
検出できたX線連星は継続した観測を実施した

今日のお話

- MAXI J1820+070 ← OISTER ToO
 - 現状の報告
- MAXI J1535-571 ← IRSF観測
 - preliminary result

- X線と可視光（明野など）の結果を合わせて論文化
Shidatsu et al. 2018, ApJ, 868, 54; Shidatsu et al., submitted to ApJ
- SEDから放射源に制限

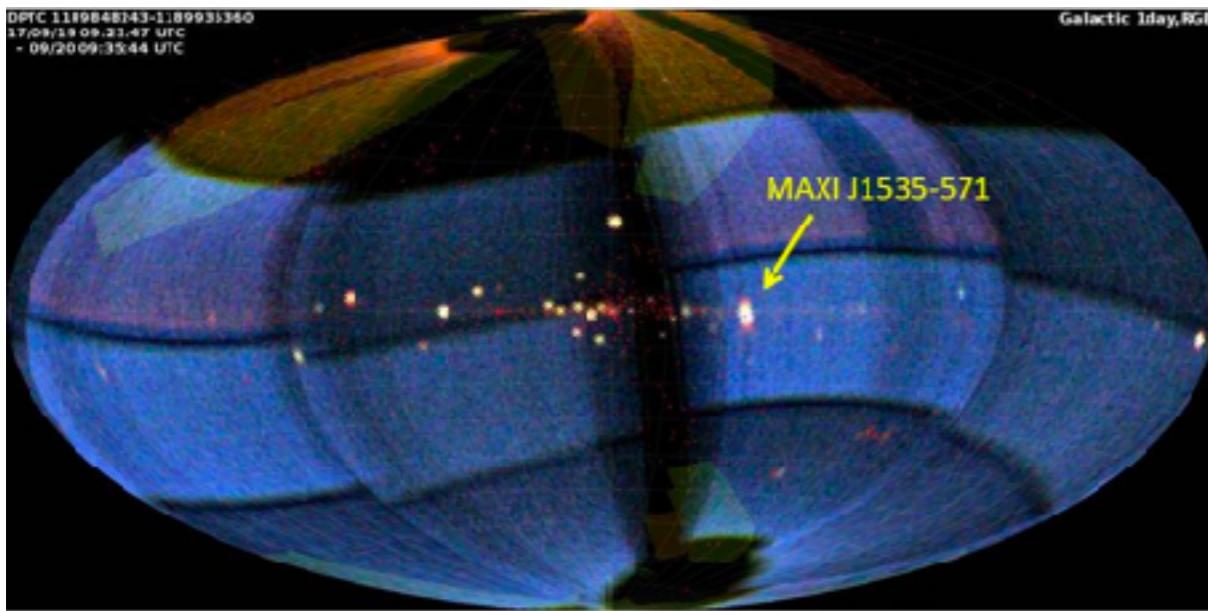
以下の図のベースはShidatsu et al. ApJ、
河合さんGROWTHミーティングスライドより



IRSF1.4m望遠鏡による
MAXI J1535-571の
近赤外線観測

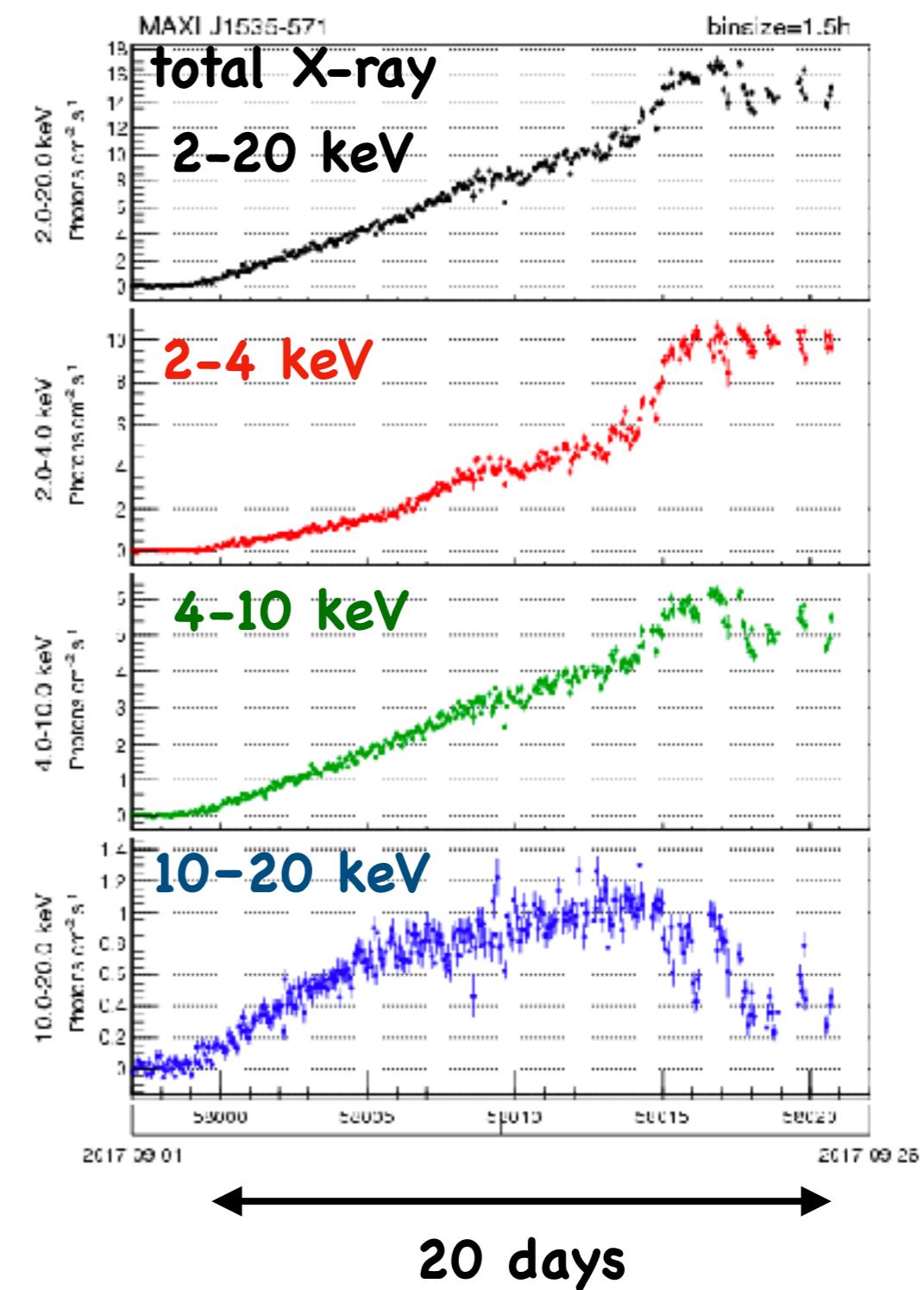
MAXI J1535-571: Low-mass X-ray binary

MAXI X-ray all sky image, 2017 Sep 19



- MAXI J1535-571
 - discovered by MAXI on 2017 Sep 2
 - almost simultaneously and independently discovered by Swift
 - on the Galactic plane
- Bright X-ray binary
 - peak X-ray flux ~ 5 Crab ($T \sim 17$ days)
 - the brightest X-ray binary in this century

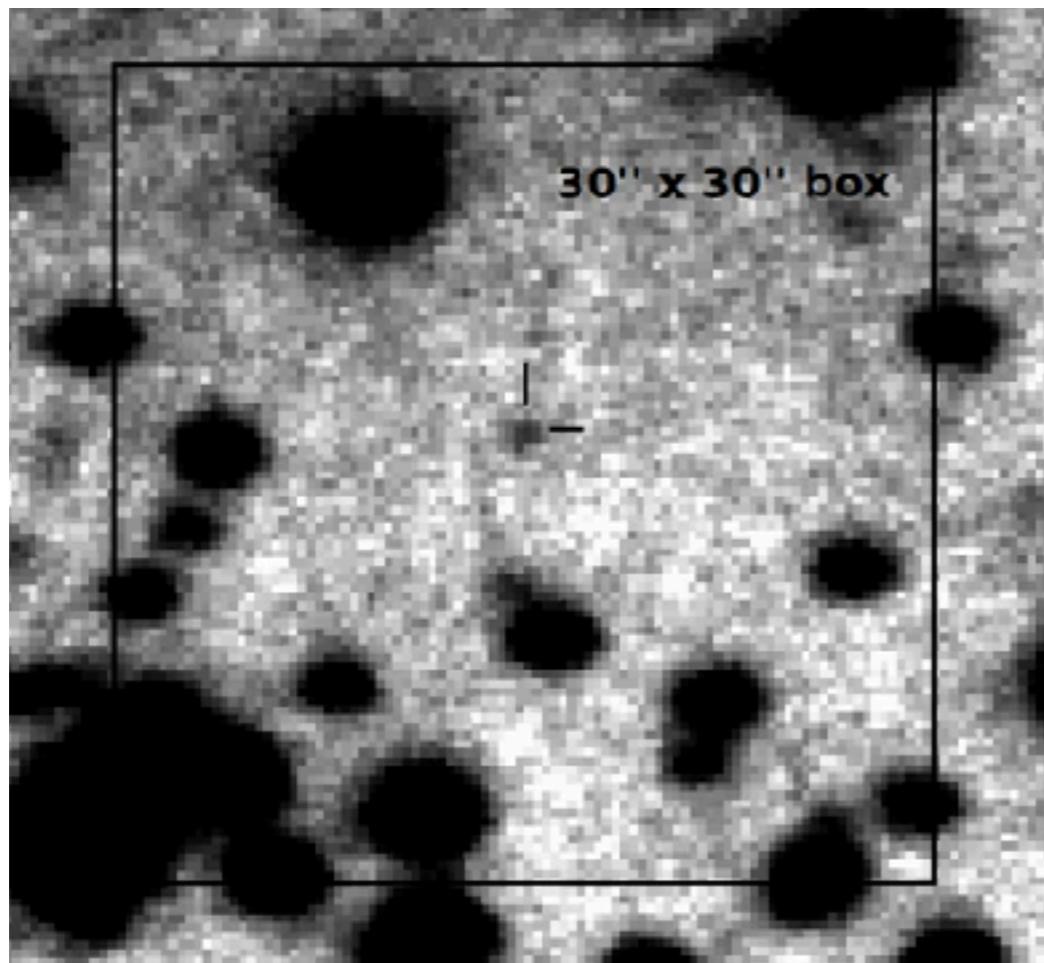
MAXI X-ray light curve



Discovery of the optical/near-IR counterpart of MAXI J1535 by other groups (T=1, 3 days)

The optical counterpart was detected next day after the X-ray discovery.

i'-band image by 0.61m B&C telescope
Atel #10702, Scaringi et al. 2017



- T=1 day: Discovery of optical i'-band counterpart, but no detection in g and r band
(Atel #10702, Scaringi et al.)
 - Extinction by interstellar dust on the galactic plane is large.
 - Obs. with longer wavelength such as near-IR is important.
- T=3 days: Identification of the near-infrared counterpart
(Atel #10716, Dincer et al.)

Observation with IRSF 1.4 m telescope

Observation



- 2017 Sep 6 – Oct 2:
 - ~3 hours continuous observation for several nights
- Oct 2 - now
 - monitoring observation almost once every month
- observe J ($1.2\mu\text{m}$), H ($1.6\mu\text{m}$), Ks ($2.3\mu\text{m}$) simultaneously

Sutherland observatory in South Africa

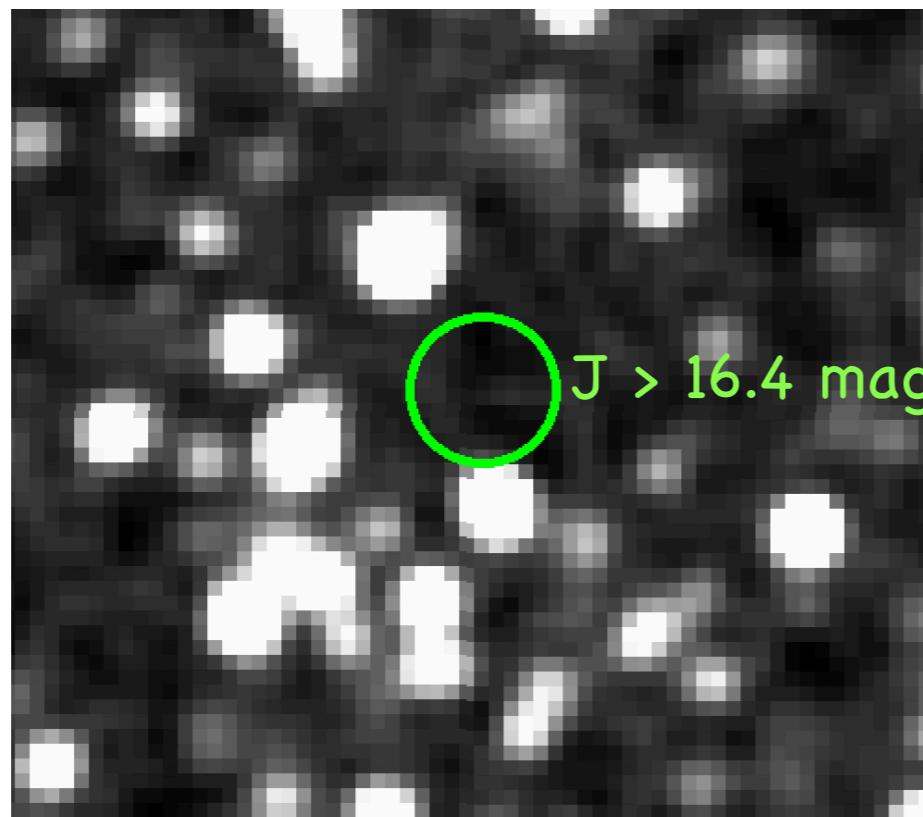
- Southern Hemisphere
- MAXI J1535-571 is not observable from Japan.

Our near-IR observation

This is the first night of our follow-up observation.

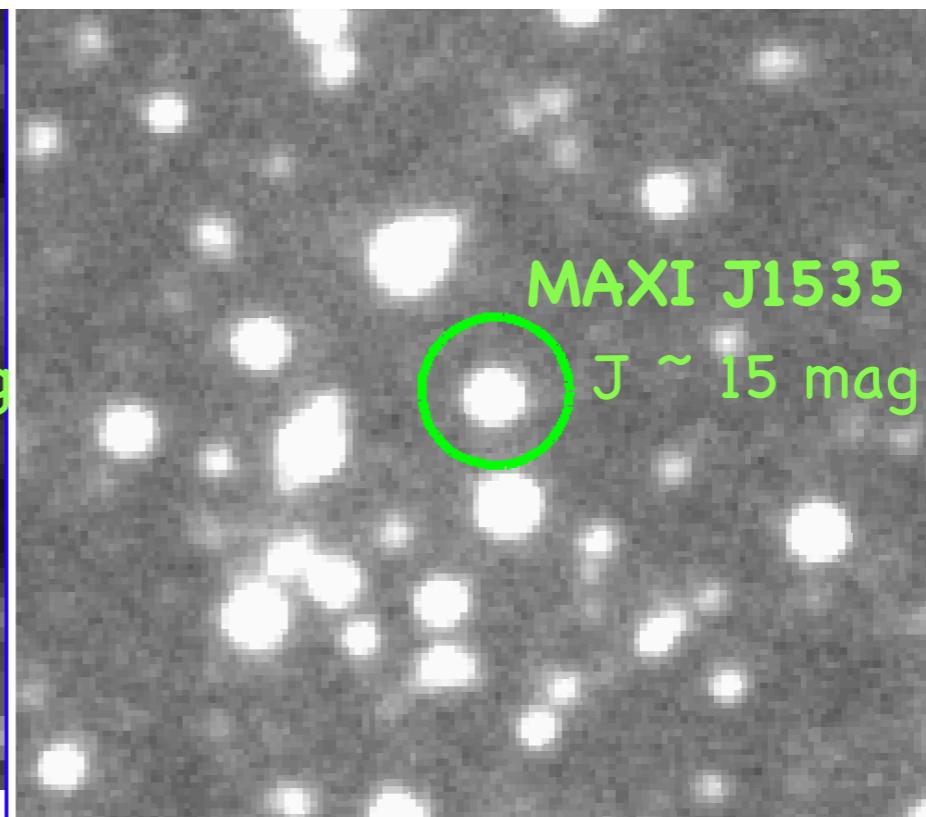
Before the X-ray outburst

2MASS archive image in J band



After the X-ray outburst

IRSF 1.4m telescope J-band image



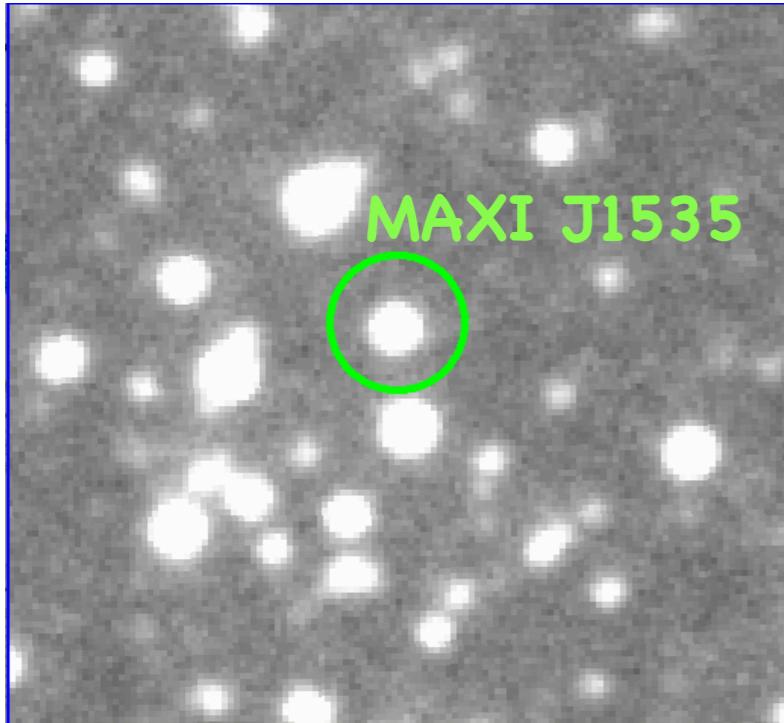
We detected the near-IR uncatalogued source

reported by Atel #10716 (Dincer et al. 2017).

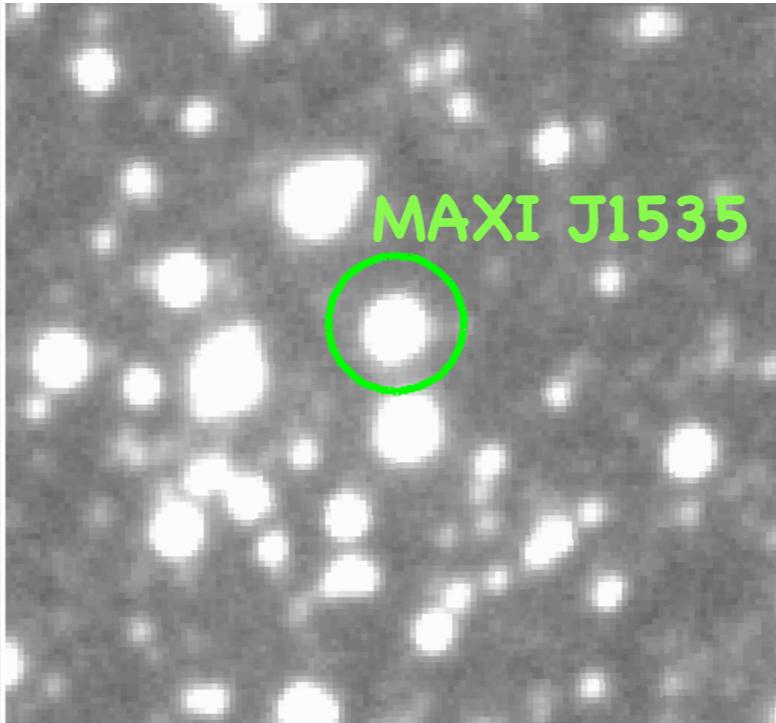
Our near-IR observation

We detected MAXI J1535 with J, H and Ks band.

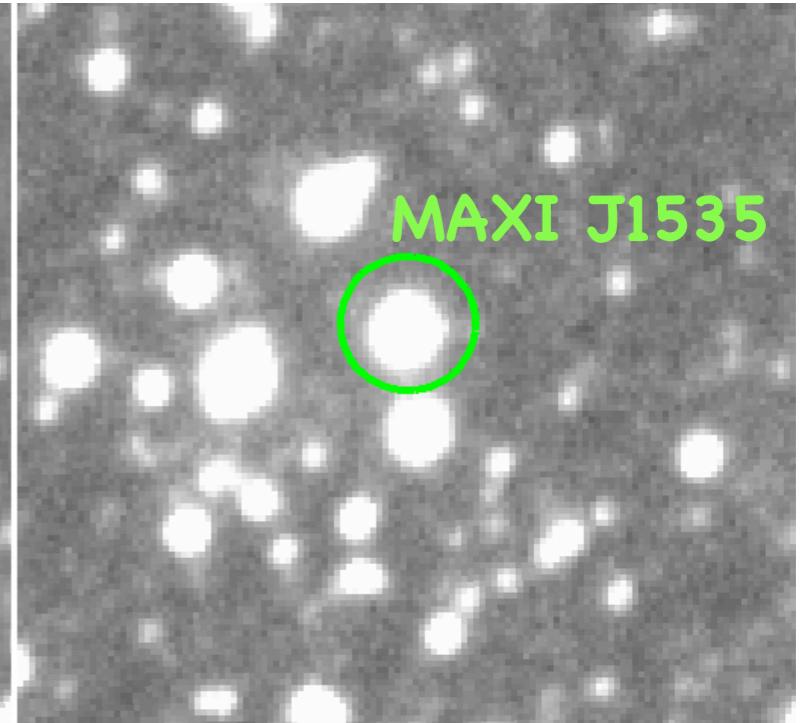
J band (1.2micron)



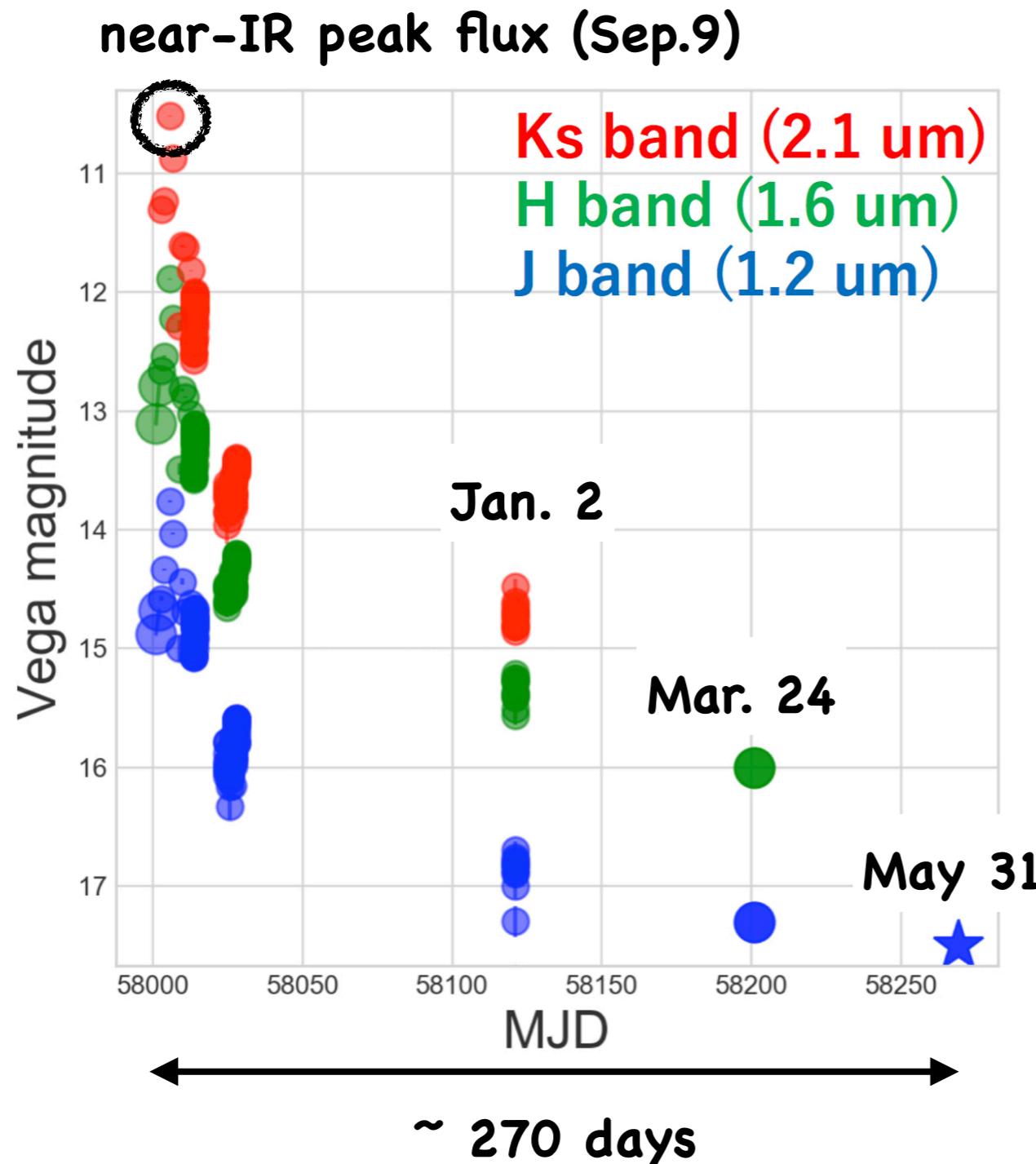
H band (1.6micron)



Ks band (2.1micron)



Our near-IR observation is on-going



- Since this night, we have performed near-IR monitoring observation.
- At least up to 2018 Sep, we detected MAXI J1535.
- We are now reducing and analyzing all the data.
- In this talk, we focus on 2017 Sep 17 observation when intranight short-term variation is clearly detected.

Summary

- MAXI J1820+070, MAXI J1535-571など小質量X線連星の追観測をしている
- MAXI J1820+070
 - OISTER可視光、近赤外線、X線でSEDをかいて放射成分を制限 (Shidatsu et al. 2018, ApJ)
 - 短時間変動の解析を現在進めている
- MAXI J1535-571
 - IRSFで発見から270日以上観測をおこなった