

# **K**-GMT Science Program: Status and Future Plan

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❖ an official interface bet. KASI and GMTO  
(~29 people incl. researchers, engineers, supporting staffs, etc.)

**K-GMT  
Management**

**K-GMT Optical  
Astronomical  
Technology Group**

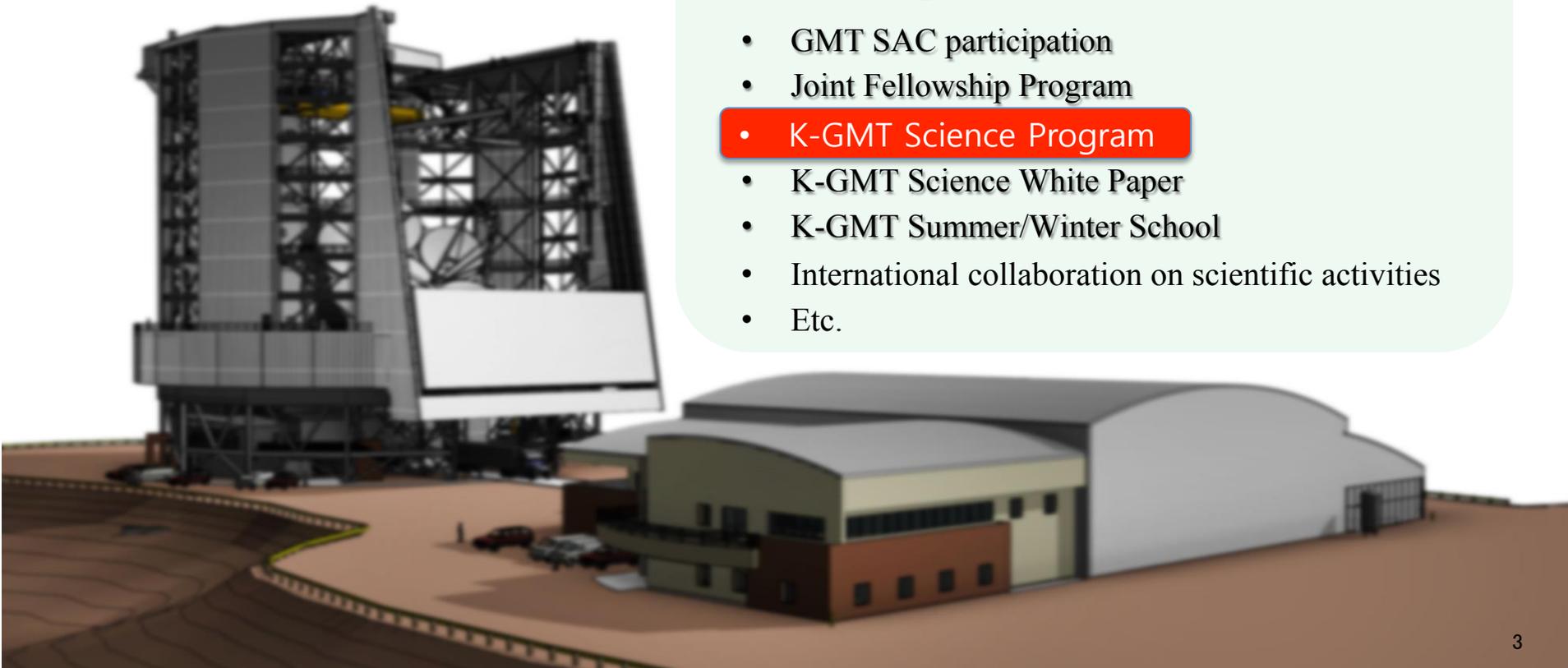
**K-GMT  
Science Group  
(KGSG)**

# K-GMT Science Group: Missions

To Lead and Support the Development of Research Capability of the Community

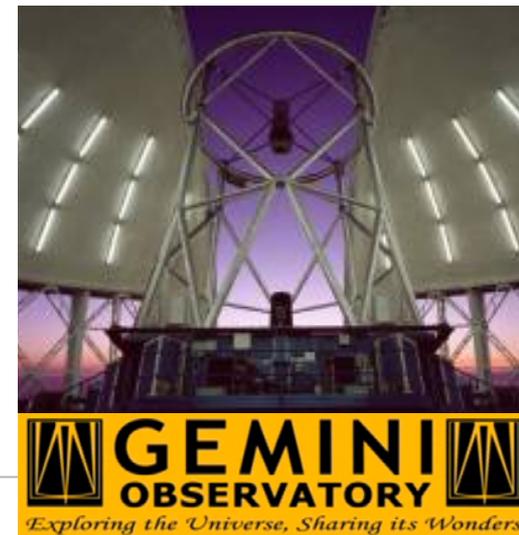
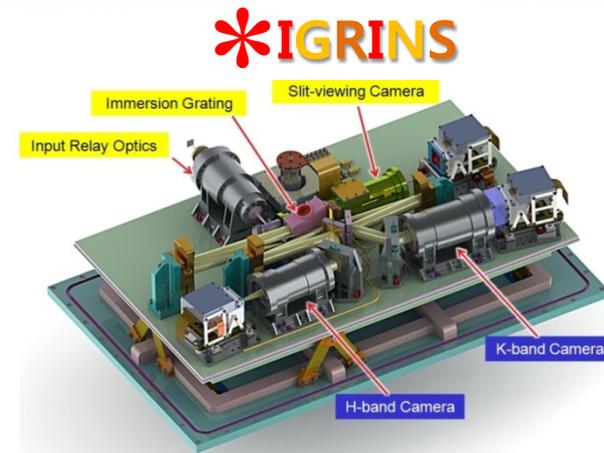
KGSG Operations include:

- GMT SAC participation
- Joint Fellowship Program
- K-GMT Science Program
- K-GMT Science White Paper
- K-GMT Summer/Winter School
- International collaboration on scientific activities
- Etc.



# K-GMT Science Program

- Provides Korean community with access to large telescope/observing facilities
  - Phase I: 2009~2013 (CFHT, AAT, UKIRT)
  - Phase II: 2014~
    - Open time to Korean community
    - MMT: 2014~
    - Gemini: 2015~
    - IGRINS@McD/DCT: 2014~



# K-GMT Science Program

Acting as an interface bet. Korea and Observatories  
i.e. "virtual observatory"

 한국천문연구원  
K-GMT SCIENCE GROUP

K-GMT Science Program

TAC  
Obs. Support  
Tech. Support



한국천문학회  
THE KOREAN ASTRONOMICAL SOCIETY



McDonald Observatory  
The University of Texas at Austin



The MMT Observatory  
A joint facility of The Smithsonian Institution and The University of Arizona



Exploring the Universe, Sharing its Wonders

# K-GMT Science Program

Aim to expand the program to include GMT and to establish "K-GMT Observatory" system

**KASI 한국천문연구원**



**한국천문학회**  
THE KOREAN ASTRONOMICAL SOCIETY



**McDonald Observatory**  
The University of Texas at Austin



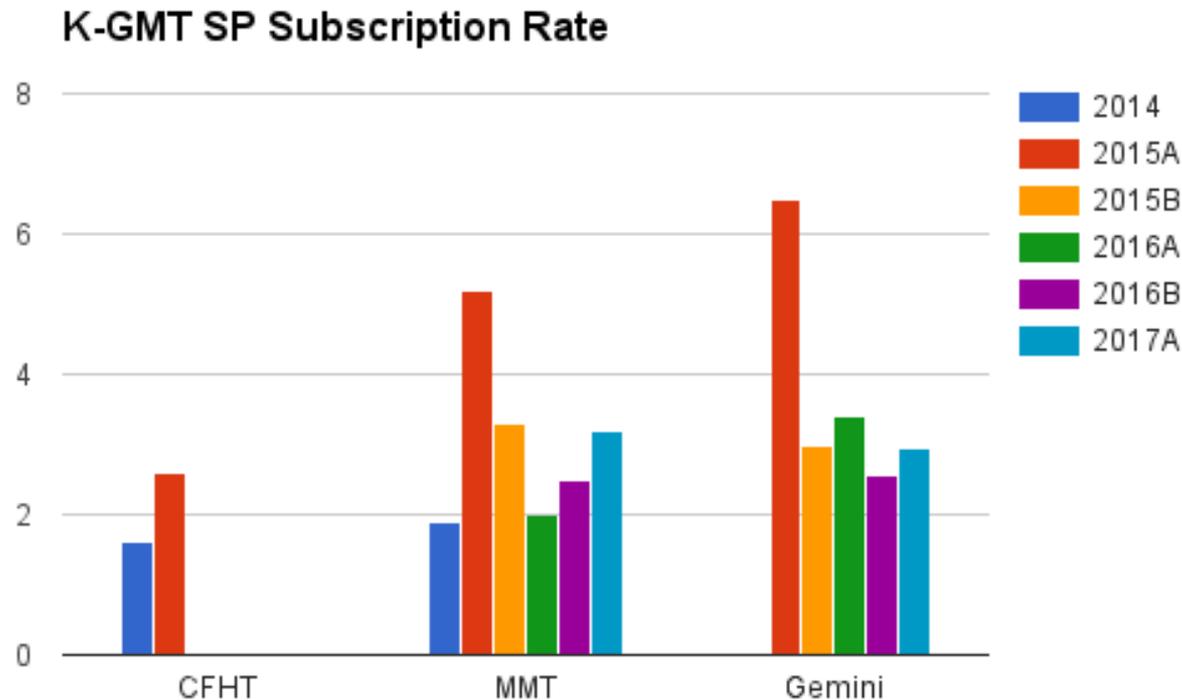
**The MMT Observatory**

A joint facility of The Smithsonian Institution and The University of Arizona



# K-GMT Science Program

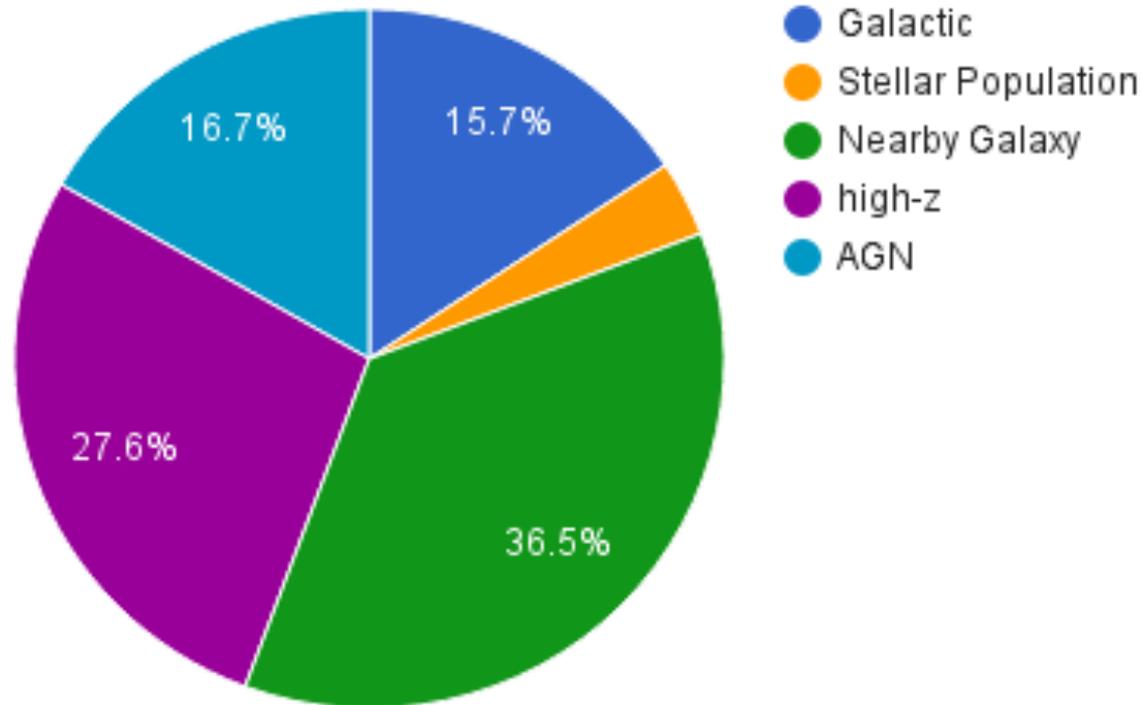
- Proposal Call:
  - 2 times per year (March, Sept)
  - About ~30+ proposals (on average) received
  - Oversubscription rate ~ 3.0 (on average)



# K-GMT Science Program

- Research Topics

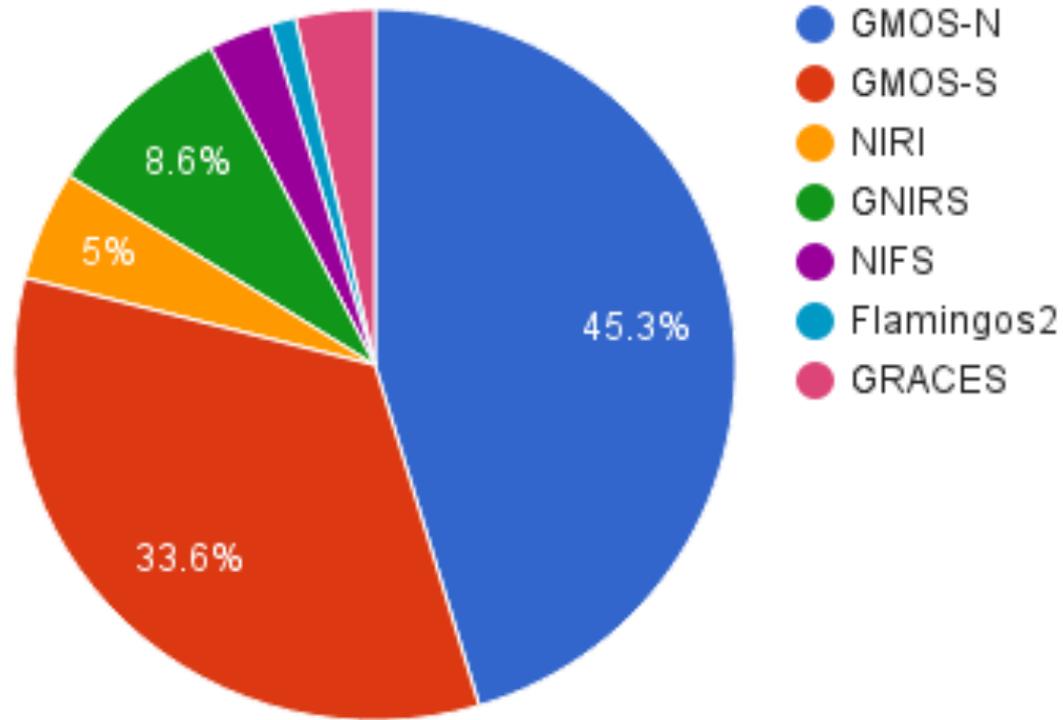
K-GMT SP Topics (2015B)



# K-GMT Science Program

- Instrument in Demand

K-GMT SP Instruments (2015B)



## ❖ Lee et al. 2015, ApJ, 804, 63 (May 2015)

THE ASTROPHYSICAL JOURNAL

### OPTICAL SPECTROSCOPY OF SUPERNOVA REMNANTS IN M81 AND M82

Myung Gyoon Lee<sup>1</sup>, Jubee Sohn<sup>1</sup>, Jong Hwan Lee<sup>1,2</sup>, Sungsoon Lim<sup>1,3</sup>, In Sung Jang<sup>1</sup>, Youkyung Ko<sup>1</sup>,  
Bon-Chul Koo<sup>1</sup>, Narae Hwang<sup>4</sup>, Sang Chul Kim<sup>4,5</sup>, and Byeong-Gon Park<sup>4,5</sup>

Published 2015 May 4 • © 2015. The American Astronomical Society. All rights reserved. • [The Astrophysical Journal](#),  
Volume 804, Number 1

2015 SPRING KAS MEETING @ SNU

## How Much Do We Understand The Properties Of Supernova Remnants In M81 And M82?

Lee. M. G. et al. 2015,  
ApJ, accepted

2015.04.15

**Jubee Sohn (Seoul National University)**

Myung Gyoon Lee (SNU), Jong Hwan Lee (Airforce),  
Sungsoon Lim (PKU), In Sung Jang (SNU)  
Youkyung Ko (SNU), Bon-Chul Koo (SNU)  
Narae Hwang (KASI), Sang Chul Kim (KASI),  
Byeong-Gon Park (KASI)

*The First Paper from  
K-GMT SP MMT program!*

❖ Kim, Im et al. 2015 ApJ 813, L35 (Nov. 2015)

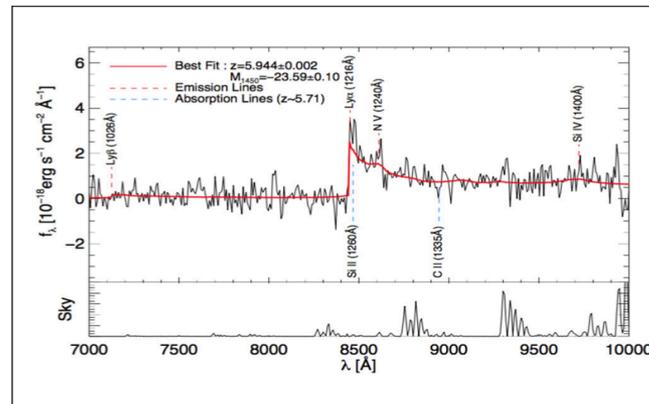
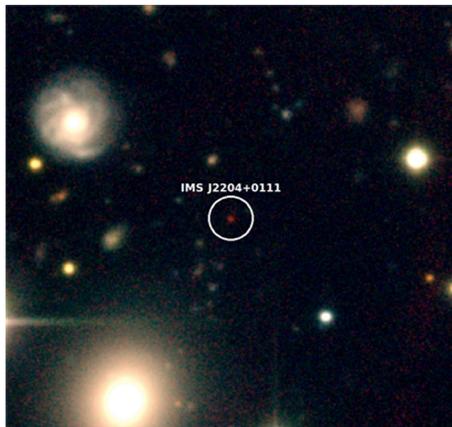
THE ASTROPHYSICAL JOURNAL  
LETTERS

## DISCOVERY OF A FAINT QUASAR AT $z \sim 6$ AND IMPLICATIONS FOR COSMIC REIONIZATION

Yongjung Kim<sup>1,2</sup>, Myungshin Im<sup>1,2</sup>, Yiseul Jeon<sup>1,2</sup>, Minjin Kim<sup>3,4</sup>, Changsu Choi<sup>1,2</sup>, Jueun Hong<sup>1,2</sup>, Minhee Hyun<sup>1,2</sup>, Hyunsung David Jun<sup>1,5</sup>, Marios Karouzos<sup>2</sup>, Dohyeong Kim<sup>1,2</sup> [Show full author list](#)

Published 2015 November 4 • © 2015. The American Astronomical Society. All rights reserved. • [The Astrophysical Journal Letters](#), Volume 813, Number 2

*The First Paper from K-GMT SP Gemini program!*



**Discovery of a  $z \sim 6$  quasar:** The discovery of a faint quasar at redshift  $z \sim 6$  helps to constrain the role of such objects as the sources of reionization in the early Universe, suggesting that they do not contribute significantly. Data from GMOS-South confirm the redshift and identity spectroscopically. This single source and six additional candidates from the same survey are consistent with limited contributions to reionization from the faint end of the quasar luminosity function. This is the first Korean publication as part of the Gemini partnership. Kim *et al.* 2015 *ApJ*, in press.

## ❖ Marios Karouzos et al. 2016, ApJ, 819, 148 (March 2016)

### UNRAVELING THE COMPLEX STRUCTURE OF AGN-DRIVEN OUTFLOWS. I. KINEMATICS AND SIZES

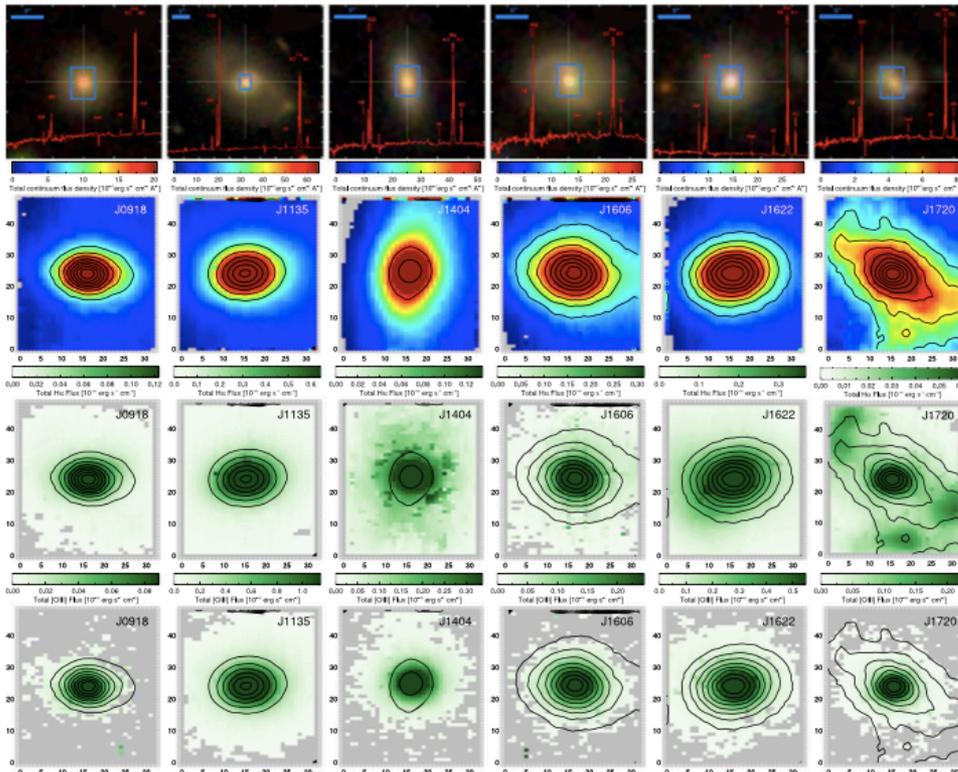
Marios Karouzos<sup>1</sup>, Jong-Hak Woo<sup>1,3</sup>, and Hyun-Jin Bae<sup>2</sup>

Published 2016 March 8 • © 2016. The American Astronomical Society. All rights reserved.

The Astrophysical Journal, Volume 819, Number 2

THE ASTROPHYSICAL JOURNAL, 819:148 (18pp), 2016 March 10

KAROUZOS, WOO, & BAE



*Gone with the wind:*  
**Revealing the complexity of ionized gas outflows in powerful Type 2 AGN in the local Universe**

Marios Karouzos – SNU  
 with Jong-Hak Woo and Hyun-Jin Bae

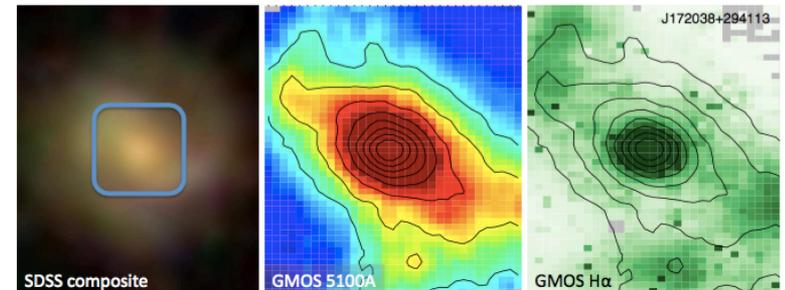
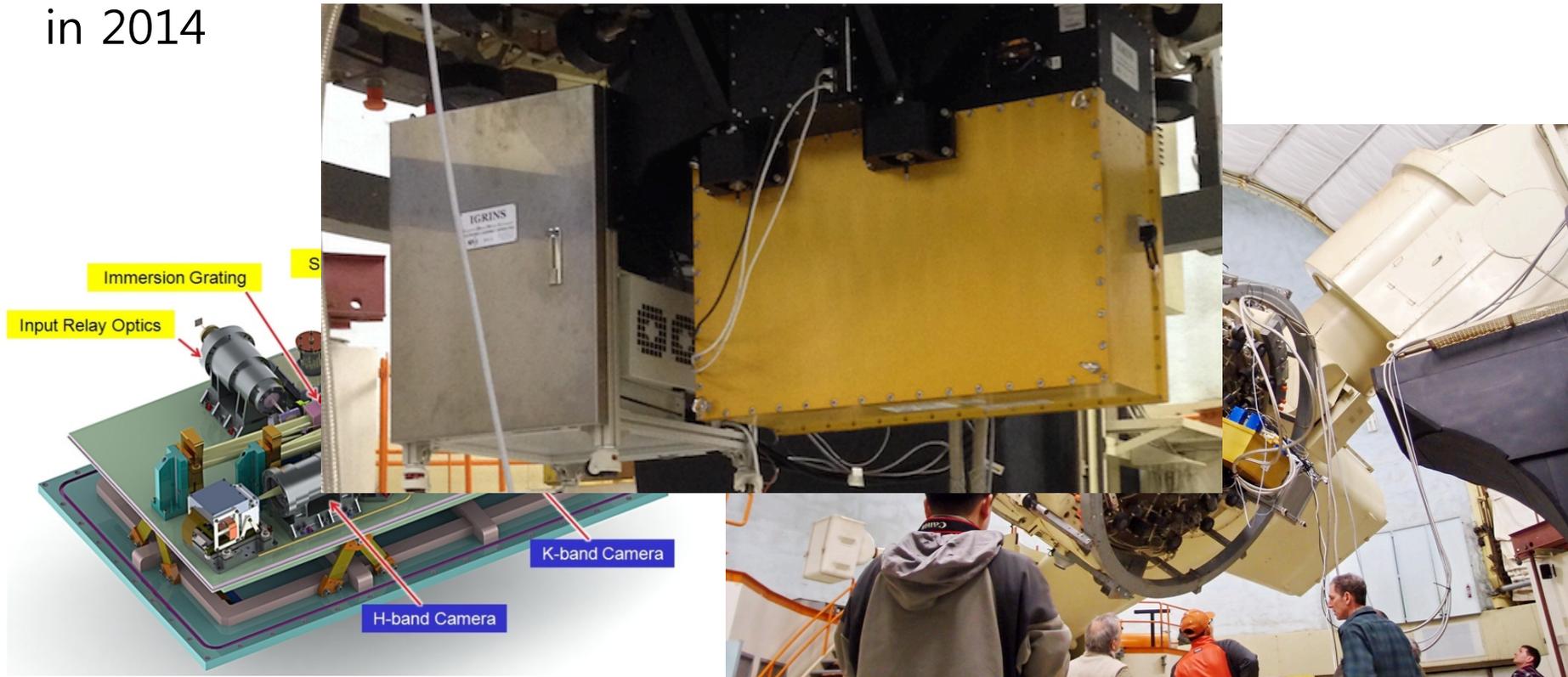


Figure 3. Top: SDSS *gri* composite images and spectra. The FOV of GMOS IFU ( $5^{\circ}0 \times 3^{\circ}5$ ) is shown with blue boxes, while the horizontal blue bars show  $5^{\circ}0$

# IGRINS

- **I**mmersion **G**Rating **I**Nfrared **S**pectrograph
- R~45,000 over H&K bands (1.4~2.5um)
- Joint development by UT Austin and KASI (K-GMT)
- Commissioning with 2.7m telescope of McDonald Observatory in 2014



# IGRINS

- IGRINS at DCT
  - Discovery Channel Telescope, Happy Jack, AZ
  - Sept. 2016~ (about 6 months per year)



# IGRINS

- IGRINS at Gemini-South
  - May 2018: 135 hours from Gemini LLP
  - Visitor instrument
  - Open to GS community for ~ 1 month

**GEMINI OBSERVATORY** **Instrumentation 2016+** **AURA**

Site	Instrument		FoV, Mode, Resolution	AO Support
Gemini-N up to 2018	GMOS-N	360-940 nm	img 5.5'x5.5' LS, MOS, IFS (5"x7") R:600-4,000	(ALTAIR)
	NIRI	1-5 μm	img 20"x20" - 120"x120"	ALTAIR
	NIFS	950-2400 nm	IFS (3"x3") R:5000	ALTAIR
	GNIRS	1-5 μm	LS R:1,800-18,000 (+img)	ALTAIR
Gemini-S GN in 2018	GMOS-S	360-940 nm	img 5.5'x5.5' LS, MOS	(GeMS)
	GSAOI	950-2400 nm	img 85"x85"	GeMS
	FLAMINGOS-2	950-2400 nm	img 85"x85" R: 1,200-3,000	(GeMS)
	GPI	900-2400 nm	contrast: 10 <sup>7</sup> at 0.4"	XAO
~2018	GHOST (GS)	360-1000 nm	US in 7' ∅ R: 50,000 + 75,000	(None)
~2022	Gen4#3 (GS)	Visible + NIR	aimed to be an LSST follow-up instrument	
Visitor INS	TEXES (GN)	5-25 μm	LS R: 4,000 - 85,000	no AO
	DSSI (GN/GS)	400-1000 nm	Dual EMCCD imaging, 20 mas resolution@650nm	teckle
	GRACES (GN)	~500-1000 nm	see CFHT/ESPaDOnS - high-res. spectro	AO
	Phoenix (GS)	1-5 μm	LS R: 50,000 - 80,000	AO
	2016 POLISH2 (GN)	optical	high precision polar	no AO
	2017 NICI	1-5 μm	coronogr	AO built-in
	2018 HIPPI (TBC)	optical		no AO
	2018 IGRINS (GS)	H+K		no AO
2018 (TBC) TIKI (GS)	mid-IR	high-contrast, mid-infrared planet imager	own XAO	
2019 (TBC) MAROON-X (TBC)	500-1000 nm	precision radial velocity (~1 m/s)	no AO	
2020 (TBC) G-IRMOS (GS)	IR	deployable IFUs	GeMS	

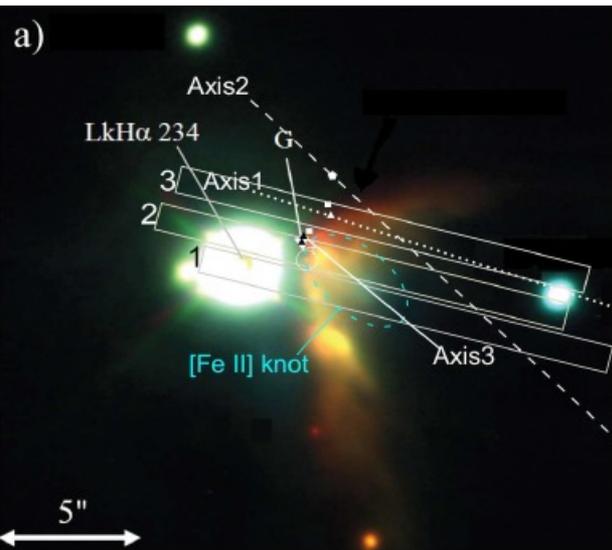
Strategic Instruments

Tactical Instruments



## ❖ Some early result from IGRINS/McDonald 2.7m

◆ Oh et al. 2016 ApJ 817, 148 (Jan. 2016)



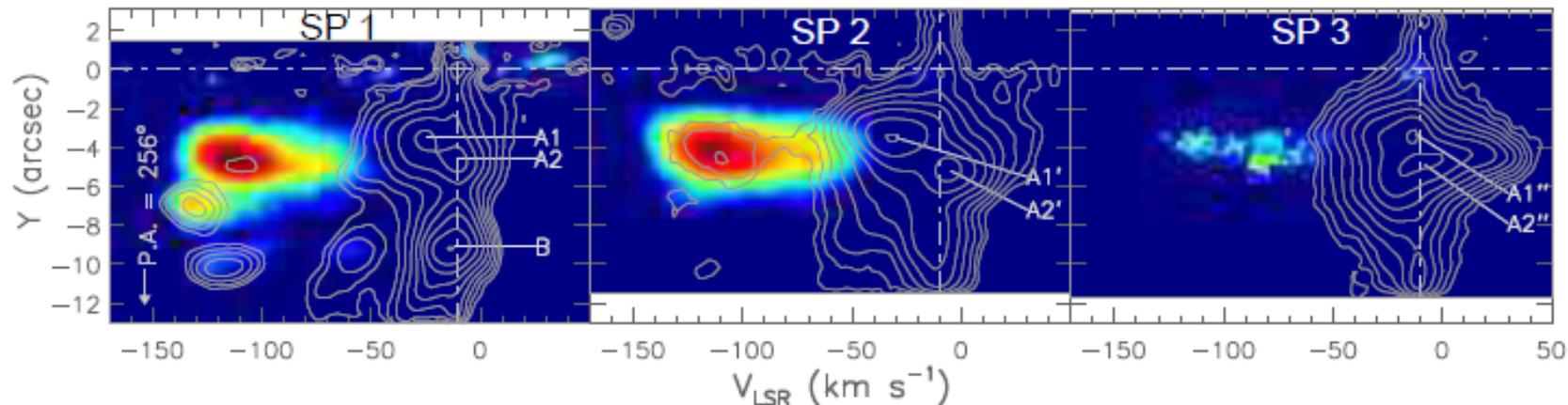
THE ASTROPHYSICAL JOURNAL

## IGRINS NEAR-IR HIGH-RESOLUTION SPECTROSCOPY OF MULTIPLE JETS AROUND LkH $\alpha$ 234\*

Heeyoung Oh<sup>1,2</sup>, Tae-Soo Pyo<sup>3,4</sup>, In-Soo Yuk<sup>1</sup>, Byeong-Gon Park<sup>1,2</sup>, Chan Park<sup>1</sup>, Moo-Young Chun<sup>1</sup>, Soojong Pak<sup>5</sup>, Kang-Min Kim<sup>1</sup>, Jae Sok Oh<sup>1</sup>, Ueejeong Jeong<sup>1,6</sup> [Show full author list](#)

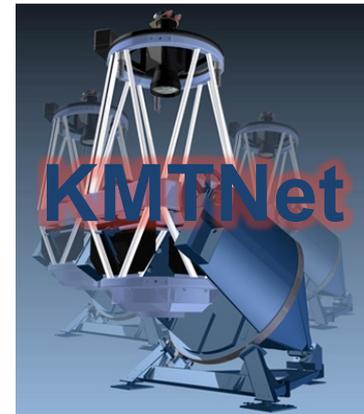
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The Astrophysical Journal, Volume 817, Number 2



# Future

- Project Plan approved in KASI until 2021 (renewable)
- Gemini:
  - Confirmed until 2018
  - Plan to use in combination with ALMA, KMTNet, LSST, GMT
  - Will be a major component of future 'K-GMT Observatory'



- MMT:
  - Confirmed until 2018 based on collaborations w/ U of Arizona
  - Expand to initiate KASI-Arizona Joint Postdoctoral Fellowship (1<sup>st</sup> offer to be made in Jan 2017)

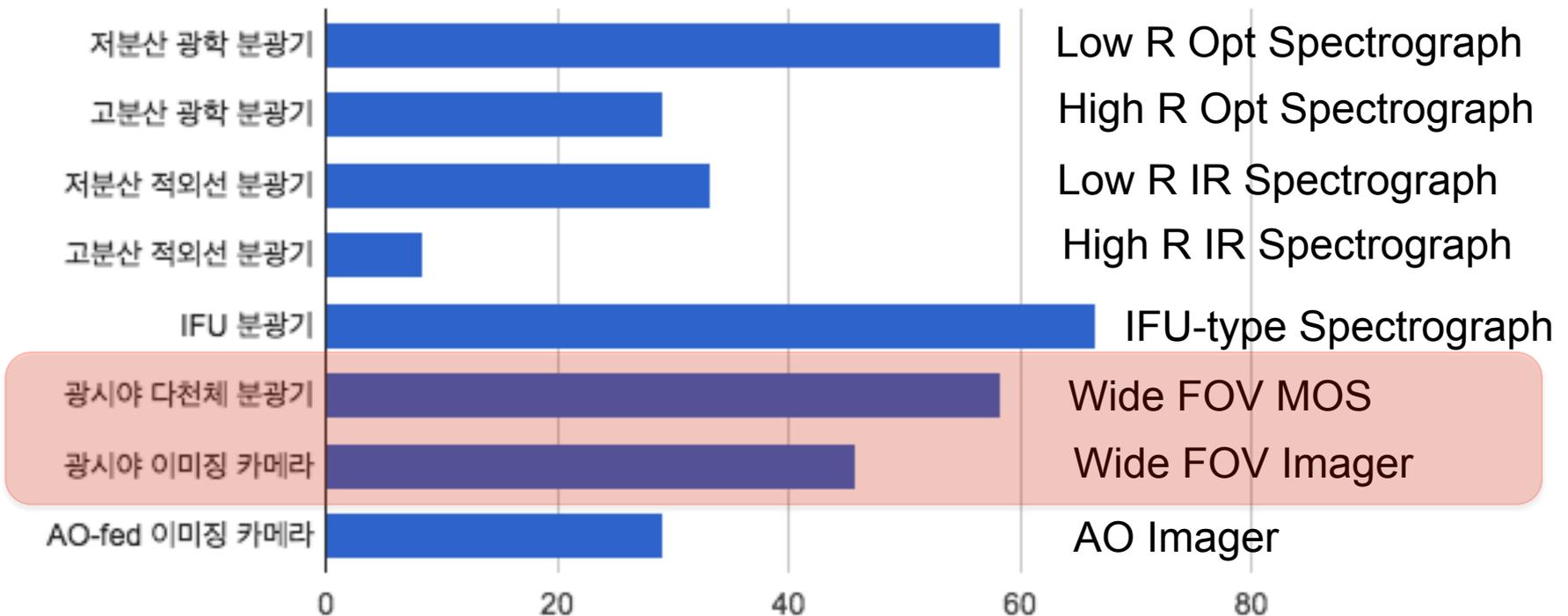
# Collaboration w/ Subaru

- Korea-Japan collaborations on various levels
- 2013 Contacted Subaru for possible future partnership
- 2014 Feb. Subaru Winter School in KASI
- 2015 Oct. Dr. Arimoto attending Korean Astronomical Society meeting
- 2016 Feb Subaru UM FY2015
  
- Next step?



# [e.g.] User Survey in 2016

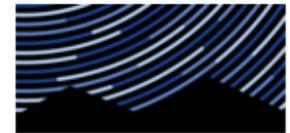
What type of Instrument do you need?



# K-GMT Science Program w/ Subaru

Future "K-GMT Observatory" network

**KASI 한국천문연구원**



**McDonald Observatory**  
The University of Texas at Austin



**한국천문학회**  
THE KOREAN ASTRONOMICAL SOCIETY



**The MMT Observatory**  
A joint facility of The Smithsonian Institution and The University of Arizona

**GEMINI OBSERVATORY**  
*Exploring the Universe, Sharing its Wonders*

Thank you