Studying Parsec Scale Jets in Star Forming Region

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Subaru Telescope

Near-IR NBFs Survey of Jets in Massive Star Forming Region with GLAO

Key words:

-. GLAO : FWHM ~ 0.2” , FoV~ 15’x 15’

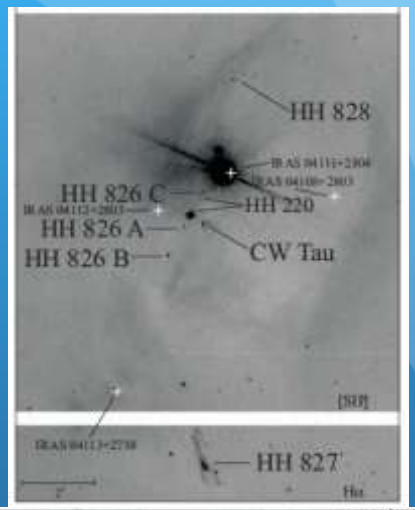
-. [Fe II], H2, Br_gamma, etc

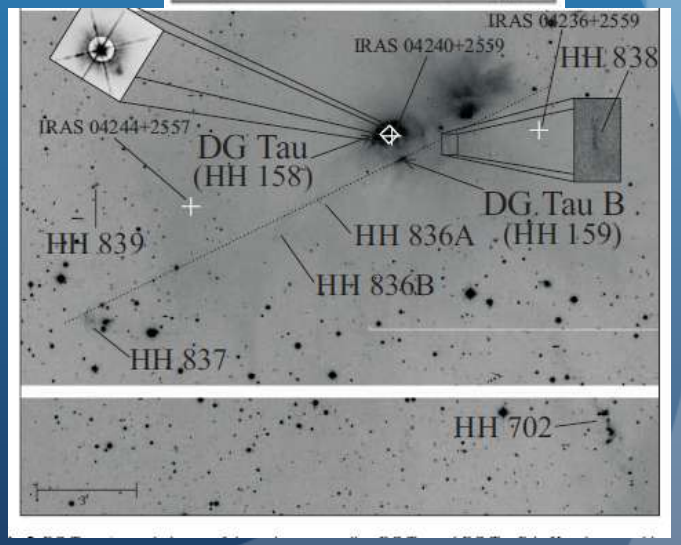
-. Parsec Scale Jets

Parsec Scale Jets: Giant HH flows

Outflow activity is associate with the all early stellar evolution states from embedded CLASS 0 to visible young stars CLASS II.

- Since mid-1990s
- Scale : a few minute length (~ 1.8' @ 1kpc)
- Shock : diagnosis of ICM (inter clump matter)
- Detail Structure in [Fe II], H2, Br_gamma, etc
- Faint Jets in distant Massive Star forming Region





McGroarrty et al. (2000)

NIR Imaging Surveys

- 2MASS
- DENNIS
- UKIDSS (WFCAM:26'x26')
- VISTA (1° x1.5°)
- …

Broad Bands

UWISH2 (H2 filter Survey)

To study outflows in imaging, NBFs observation are necessary.

MHO (Molecular Hydrogen Object) Table

Region	Map	Approx. RA Range	Approx. Dec Range	MHO #	.txt
Perseus	M2	03h 00m → 04h 00m	+25° → +35°	500-699	Per.txt
Auriga (excl. Per/Gem)	M2	03h 30m → 06h 30m	+30° → +56°	1000-1099	Aur.txt
Taurus (excl. Ori/Per)	M2	03h 00m → 05h 50m	+10° → +30°	700-799	Tau.txt
Camelopardalis	M1	04h 00m → 08h 00m	+56° → +90°	1100-1199	Cam.txt
Orion A	M3	04h 45m → 06h 00m	-15° → -04°	1-299	OriA.txt
Orion B (excl. Tau)	M3	04h 45m → 06h 00m	-04° → +16°	300-499	OriB.txt
Gemini	M3	05h 50m → 08h 00m	+14° → + 34°	1200-1299	Gem.txt
Monoceros	M3	06h 00m → 08h 30m	-13° → +14°	1300-1399, 3100-3199	Mon.txt
Puppis (excl. Vela)	M4	06h 30m → 09h 00m	-52° → -13°	1400-1499	Pup.txt
Vela	M4	07h 30m → 11h 00m	-55° → -38°	1500-1599	Vel.txt
Carina	M5	08h 00m → 12h 00m	-75° → -55°	1600-1699	Car.txt
Chameleon (excl. Car)	M5	08h 00m → 14h 00m	-85° → -70°	3000-3099	Cha.txt
Centaurus	M5	12h 00m → 15h 00m	-70° → -30°	1700-1799	Cen.txt
Circinus/Lupus	M6	15h 00m → 16h 00m	-70° → -30°	1800-1899	CirLup.txt
Scorpius	M6	16h 00m → 18h 00m	-60° → -30°	1900-1999	Sco.txt
Corona Australis	M6	18h 00m → 19h 30m	-45° → -35°	2000-2099	CrA.txt
Ophiuchus (excl. Ser)	M6	16h 00m → 18h 00m	-30° → +05°	2100-2199	Oph.txt
Serpens	M7	17h 30m → 18h 40m	-15° → +05°	2200-2299	Ser.txt
Sagittarius (excl. Ser)	M7	18h 00m → 20h 30m	-35° → -12°	2300-2399	Sgr.txt
Aquila (excl. Lyr)	M7	18h 40m → 20h 30m	-12° → +15°	2400-2499	Aqu.txt
Lyra	M8	18h 20m → 19h 00m	+5° → +45°	2500-2599	Lyr.txt
Vulpecula	M8	19h 00m → 21h 30m	+15° → +30°	2600-2699	Vul.txt
Cygnus	M9	19h 00m → 22h 00m	+30° → +55°	800-999	Cyg.txt
Cepheus (excl. Cas)	M9	19h 00m → 23h 30m	+55° → +90°	2700-2799	Cep.txt
Andromeda	M9	22h 00m → 00h 00m	+30° → +55°	2800-2899	And.txt
Cassiopeia (excl. Cep)	M1	23h 00m → 04h 00m	+50° → +90°	2900-2999	Cas.txt
Bibliography					

Currently there are **1128** entries in the MHO catalogue
(Last update: 10 June 2011)

Covering Most major Starforming regions

14’

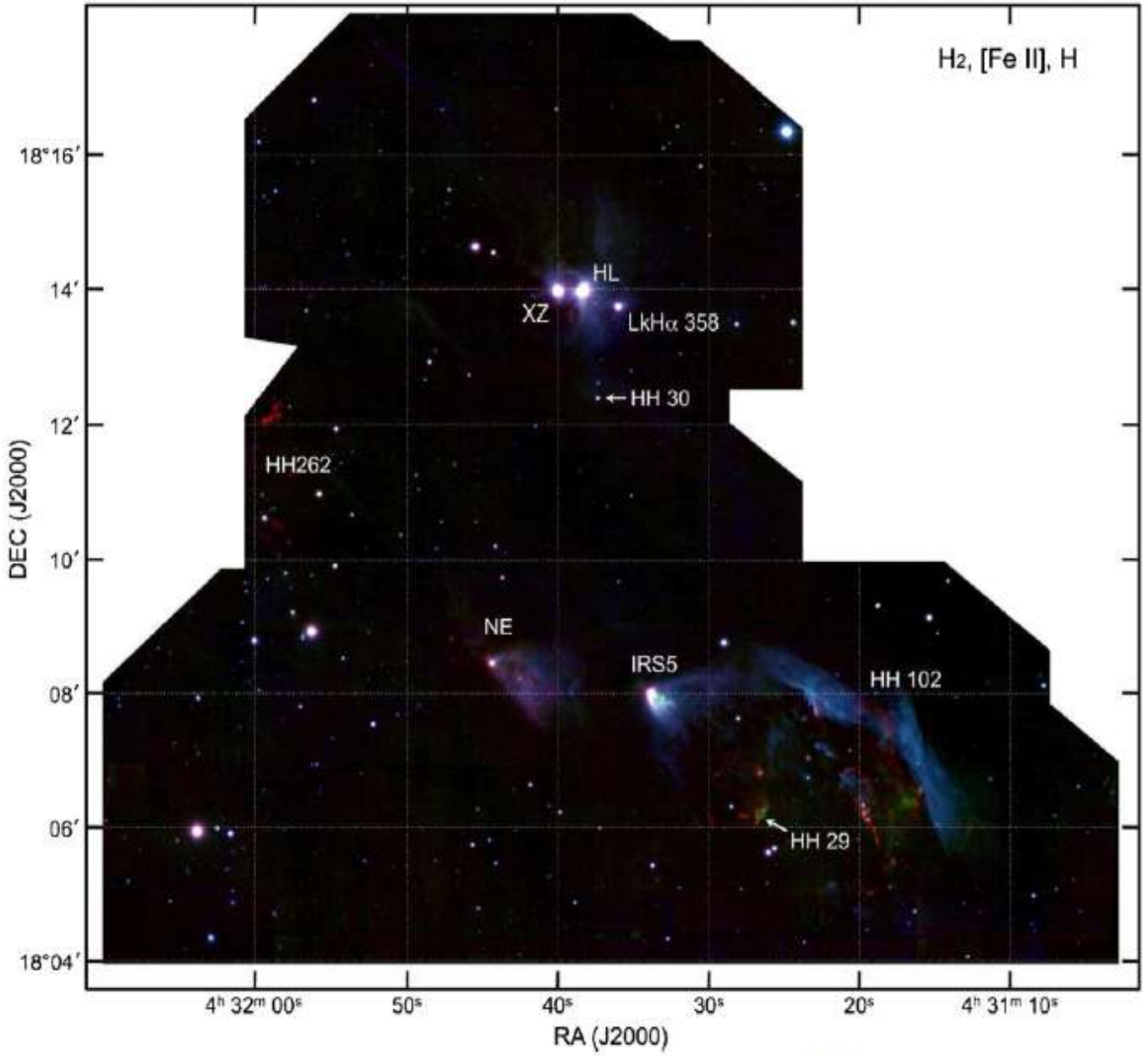
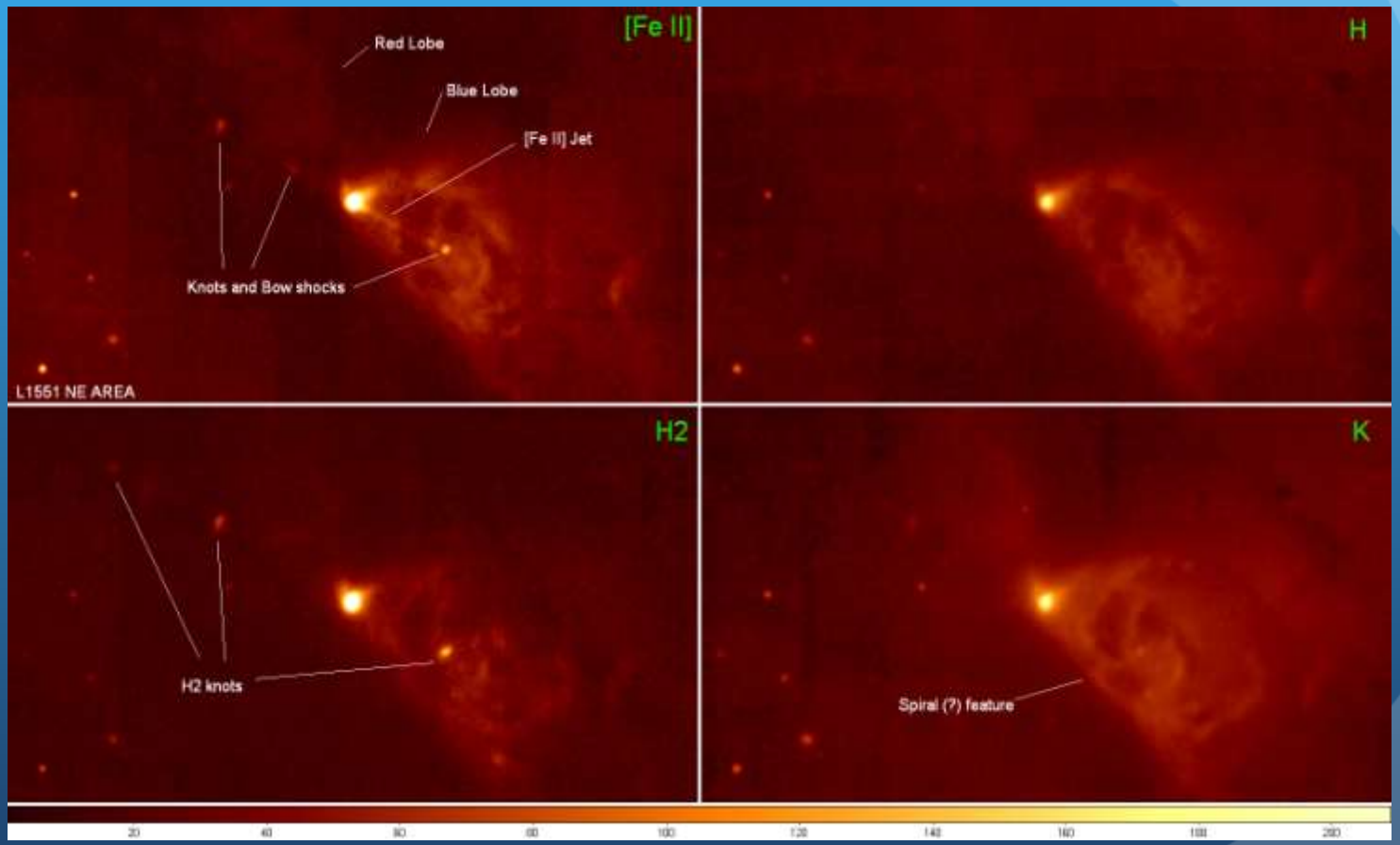


Figure 1. Composite color image of the entire observed area shown in a logarithmic scale. The blue, green, and red colors are assigned to the *H*, [Fe II], and H_2 filter frames, respectively. North is up and east is left.

Hayashi & Pyo(2009)

[Fe II] and H2 in L1551 NE



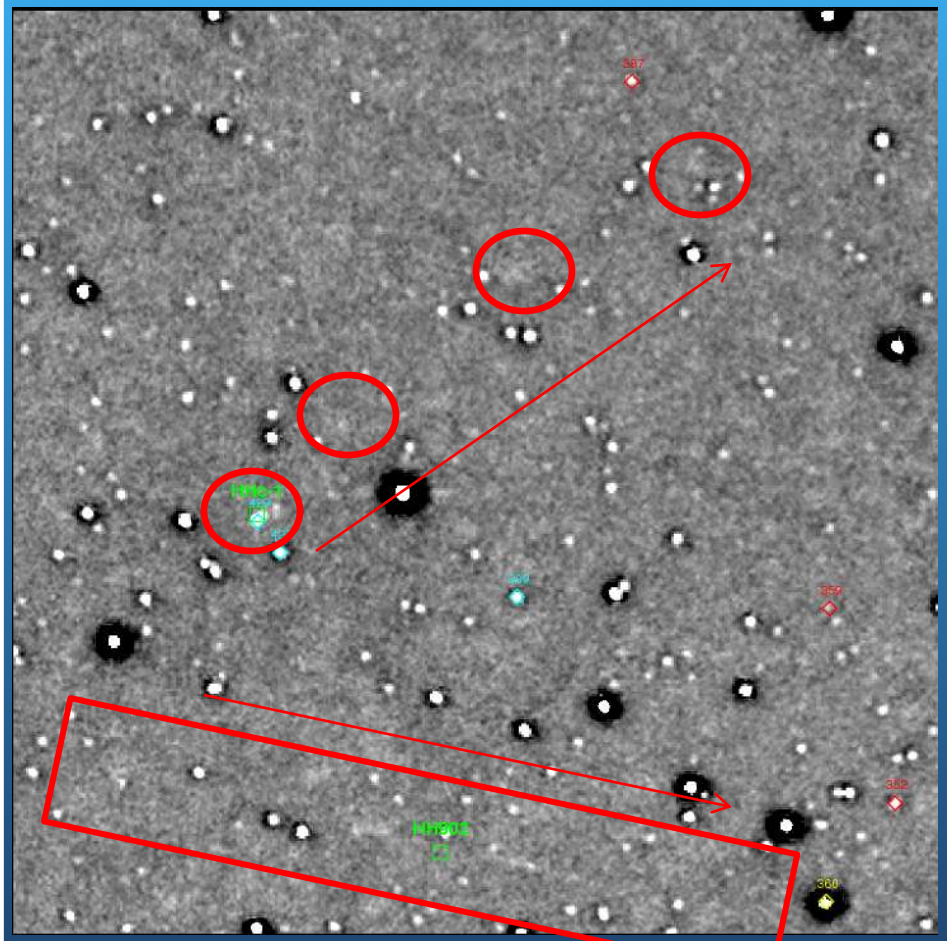
Optical emissions and [Fe II] (HST)

Smith et al. (2004)

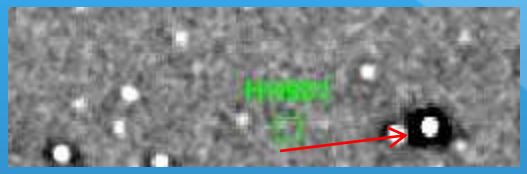
NIR [Fe II] has small extinction, clear jet structure, simple background (low scattering).

→ Detection of collimated jets and estimation of the the candidate source

Eg.) HH902, HHc-1 (Carina Nebula)



Long and sharp HH902 [FeII] jet and HHc-1 fossil flow



Faint but sharp jet of HH901

Marginal Detection of [Fe II] Jets

IRIS2/AAO
Bad Seeing: 1.5- 2.3”
30 min on-source time

SUMMARY

- Suggestion of NIR NBFs imaging survey with GLAO
- New discovery chance of [Fe II] jets in distant massive star forming region
- [Fe II] emission is good compliment tracer for outflow phenomenon for H2 emission:
  - H2 traces shocked molecular outflows.
  - [Fe II] traces shocked and partially ionized atomic jets.
- Sub-arcsecond seeing condition is essential to recognize sharp jet features.