2017 ALMA summer school

L1448 IRS1

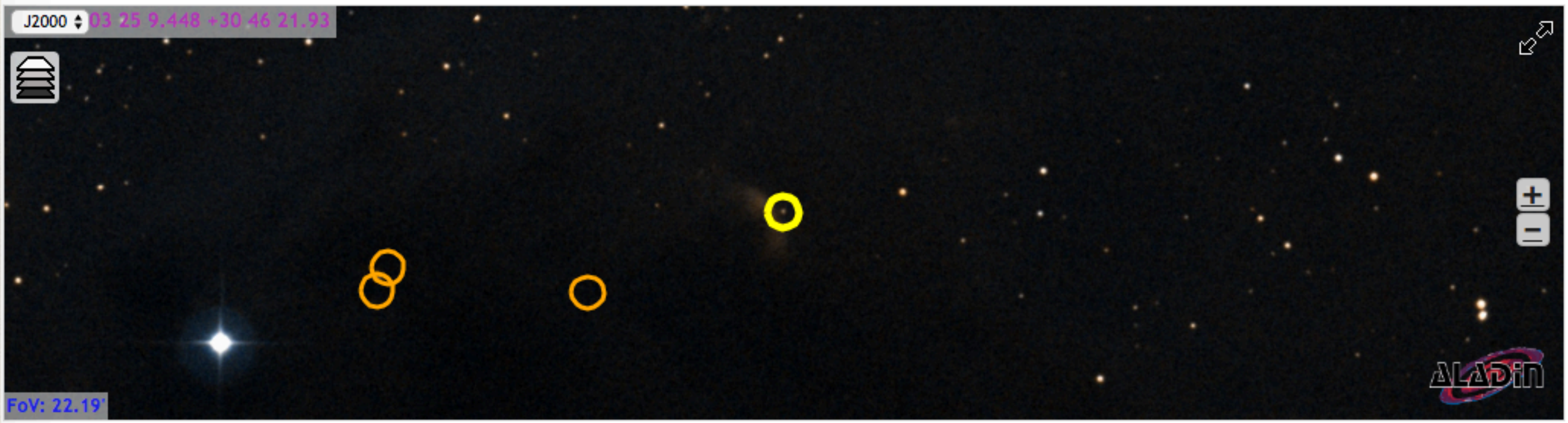
Gwanjeong Kim @ group 5

Project title
Are Close Binaries Formed through Disk Fragmentation?

PI name
Tobin, John

Proposal abstract

Over 50% of sun-like stars are found in binary/multiple systems. Their formation is thought to occur during the early stages of the star formation process, but the formation mechanism remains unclear. The most likely possibilities are either disk fragmentation or turbulent fragmentation with dynamical evolution. To understand protostellar multiplicity, we have conducted a VLA 8 mm survey of all protostars (N~80) in the Perseus molecular cloud (d=230 pc) at a resolution of 0.3" (70 AU). With this unprecedented survey, we identified 17 close proto-binary systems with separations less than 500 AU, and of these, 14 are new discoveries. While these detections are significant, the VLA data do not convey their formation mechanism. Therefore, we propose to use ALMA to observe dust continuum and molecular line emission (C18O, 13CO) toward these 17 sources to determine if these sources have circumbinary disks in the apparent dust continuum and we will use the molecular line maps to determine if the disks are rotationally-supported. This sample is large enough to reveal general trends as to whether or not binaries typically form via disk fragmentation or turbulent fragmentation.



More columns | Showing 17 of 17 rows.

	Project code	Source name	RA	Dec	Band	Integration	Release date	Velocity resolution	Frequency support	Pub
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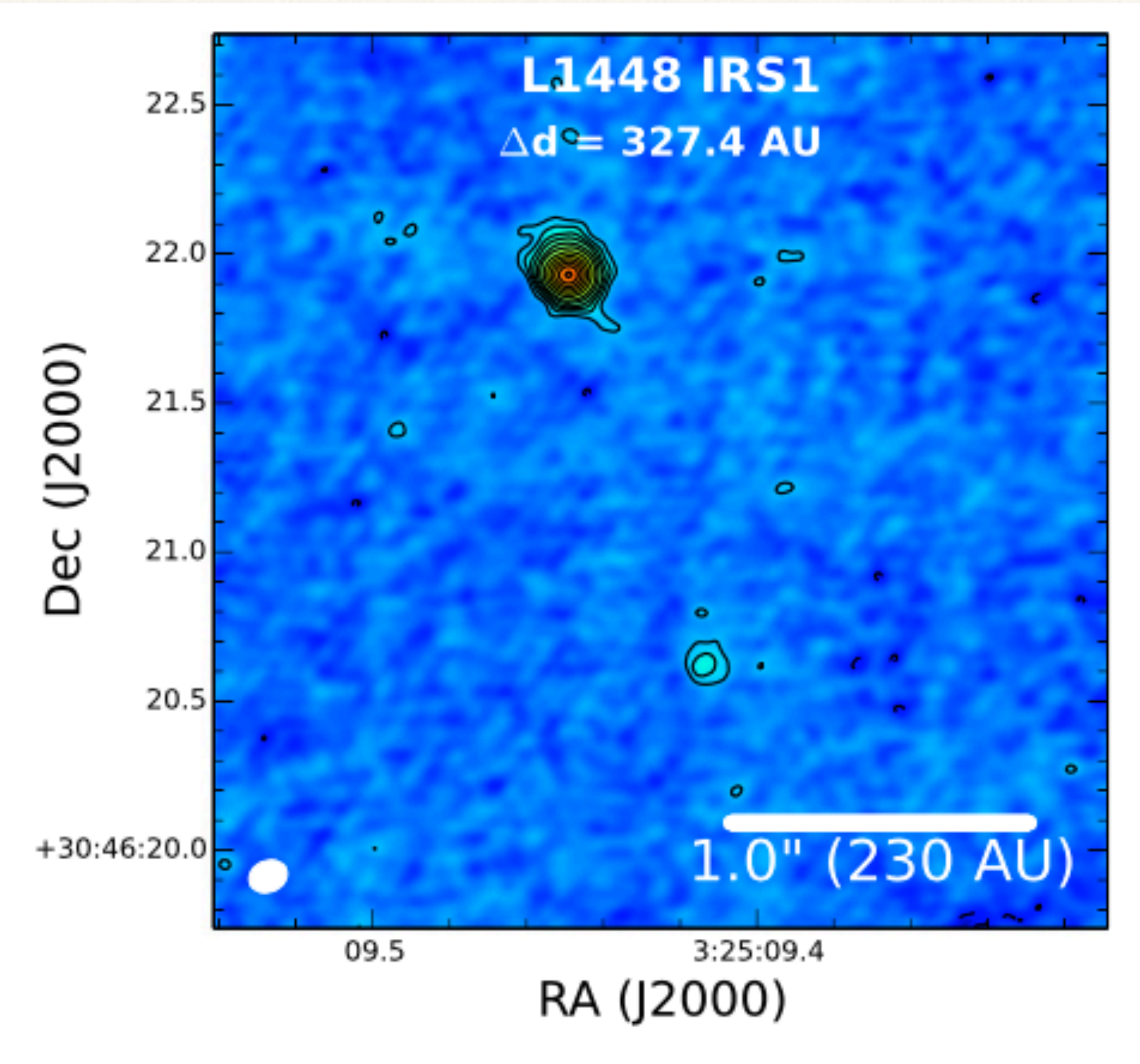

L1448IRS1-A	03:25:09.449	+30:46:21.924
L1448IRS1-B	03:25:09.413	+30:46:20.625

Class I Multiple Systems

Source	Separation ($''$)	Separation (au)	Flux Differencep (Log $[F_1/F_2]$)
L1448IRS1	1.424 ± 0.015	327.4 ± 3.5	1.02 ± 0.09

While we cannot reliably quantify our level of incompleteness, we do detect all the currently known infrared companions (i.e., EDJ2009-183 and L1448 IRS1 Connelley et al. 2008) and most millimeter companions (except for VeLLOs/candidate FHSCs). Furthermore, our observed CSF of Class I protostars

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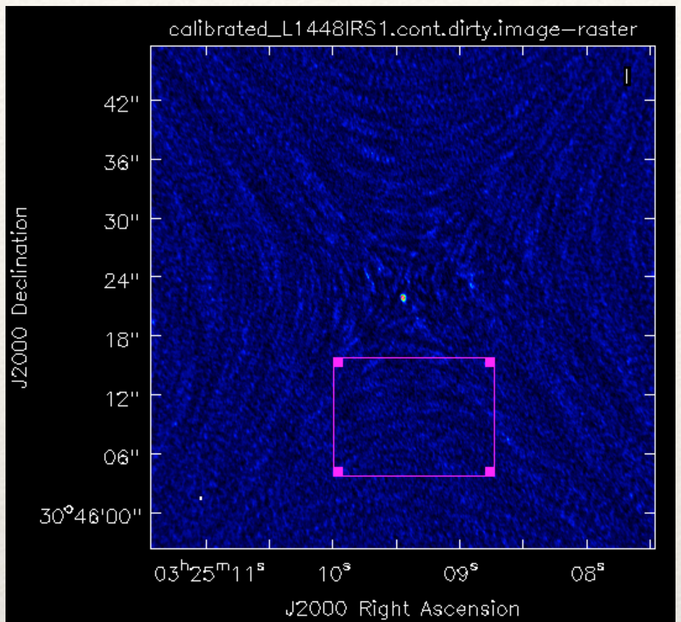

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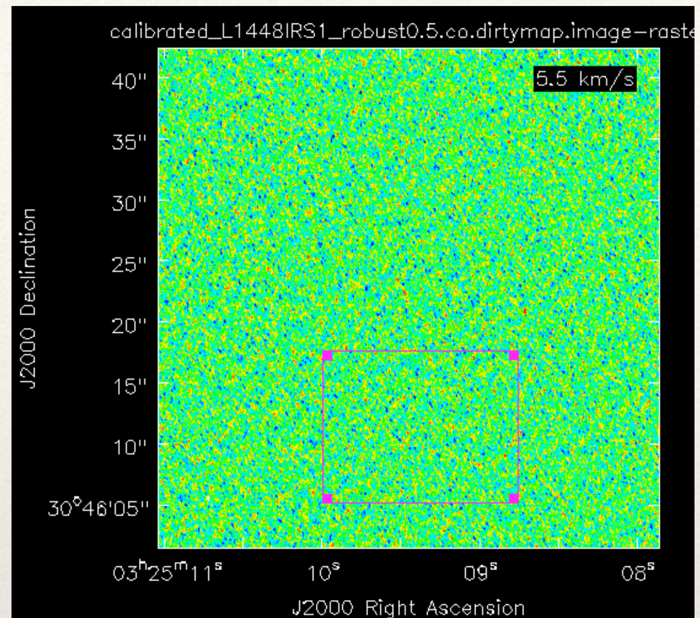

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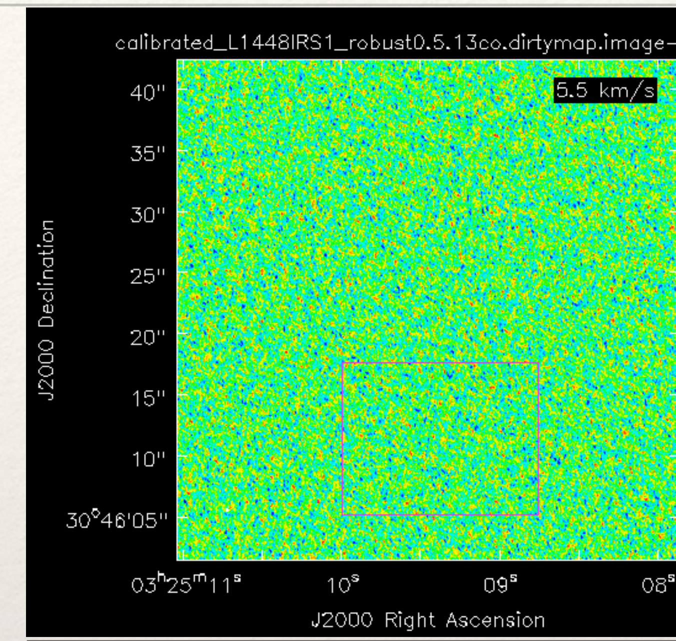

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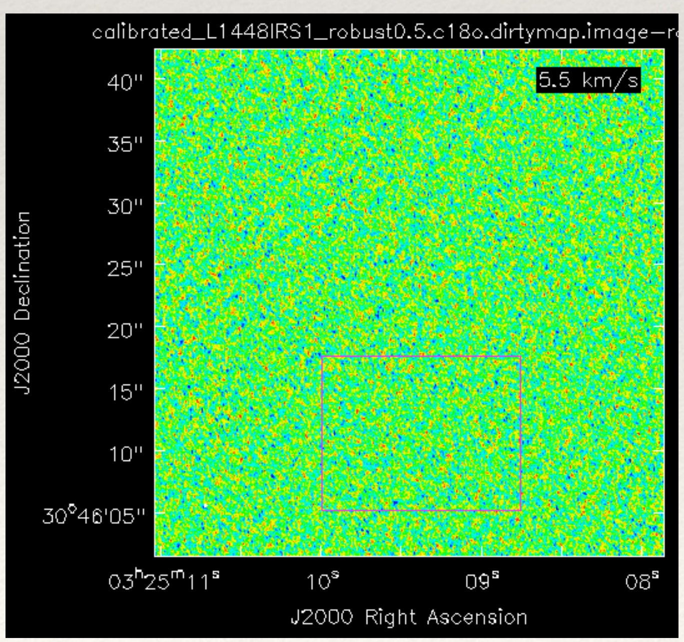
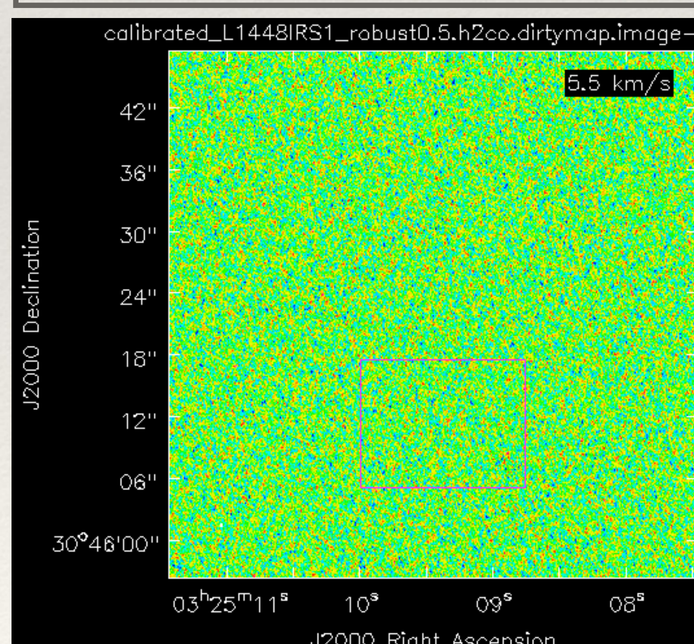


rms~1.9e-2 mJy/beam/ch



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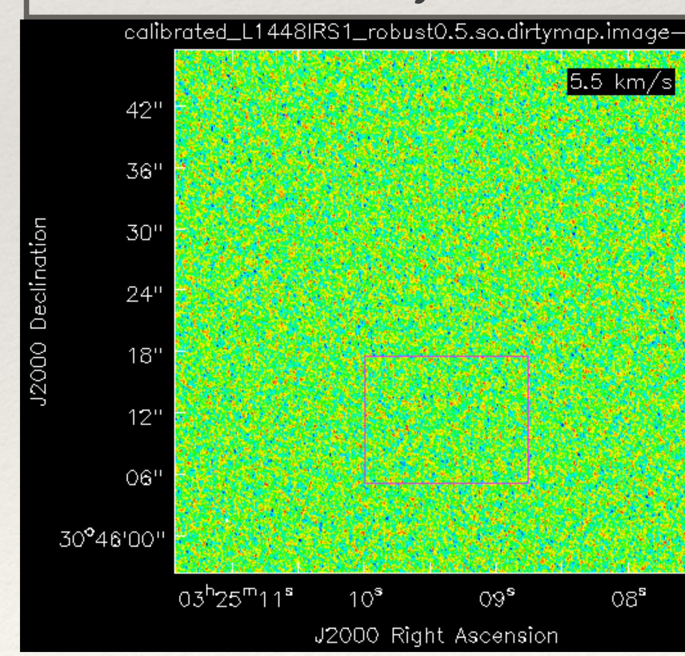
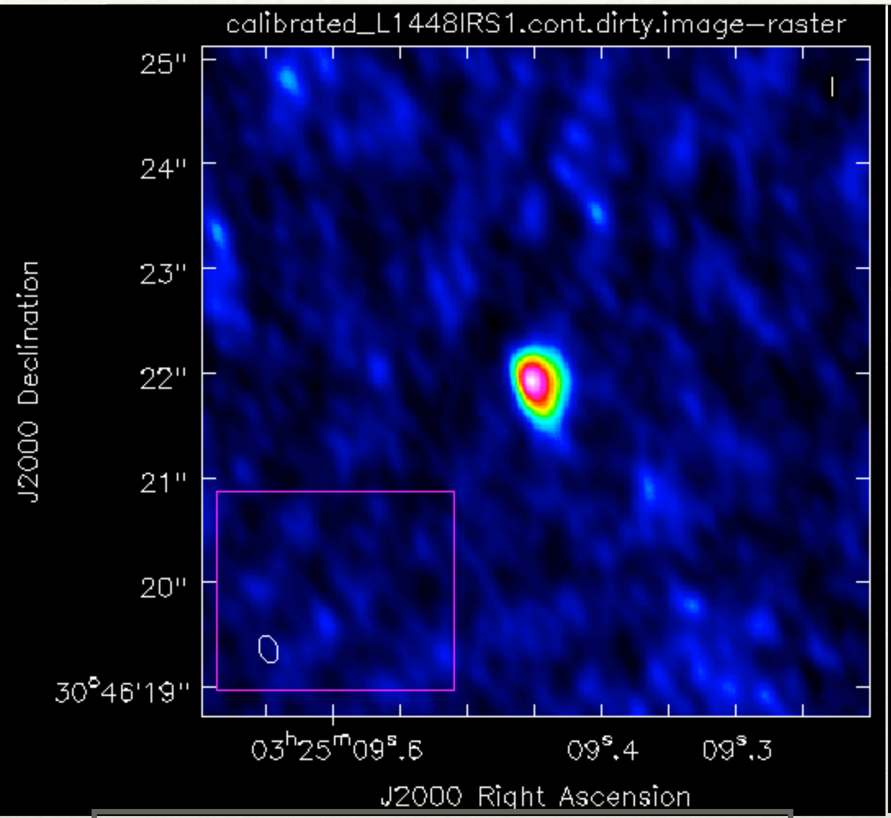
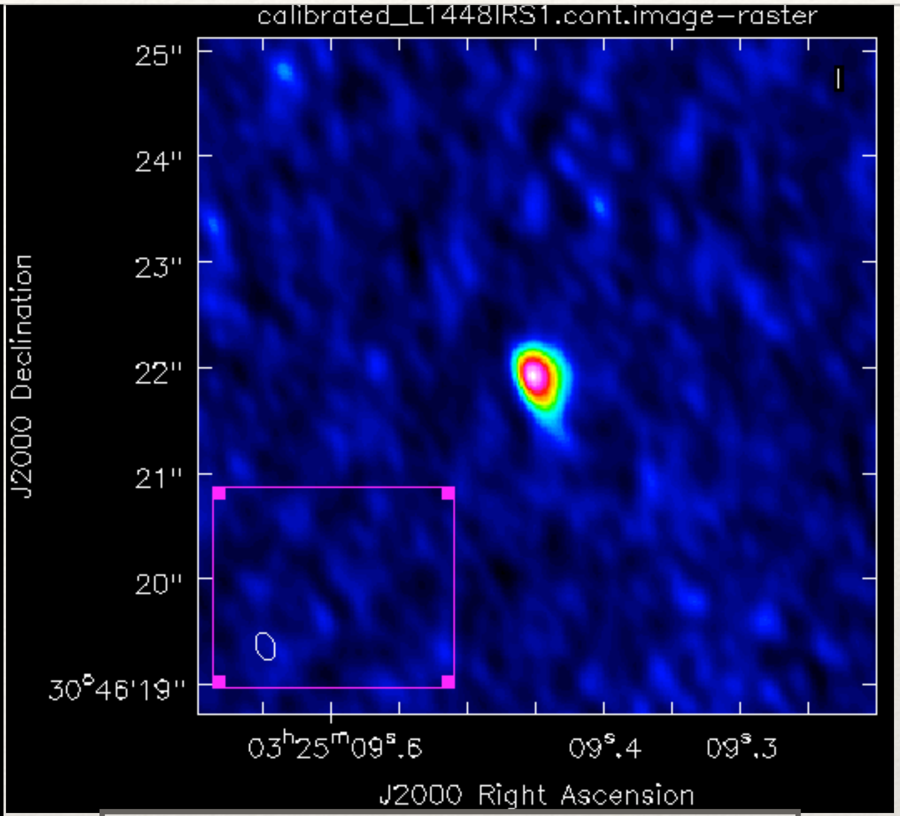


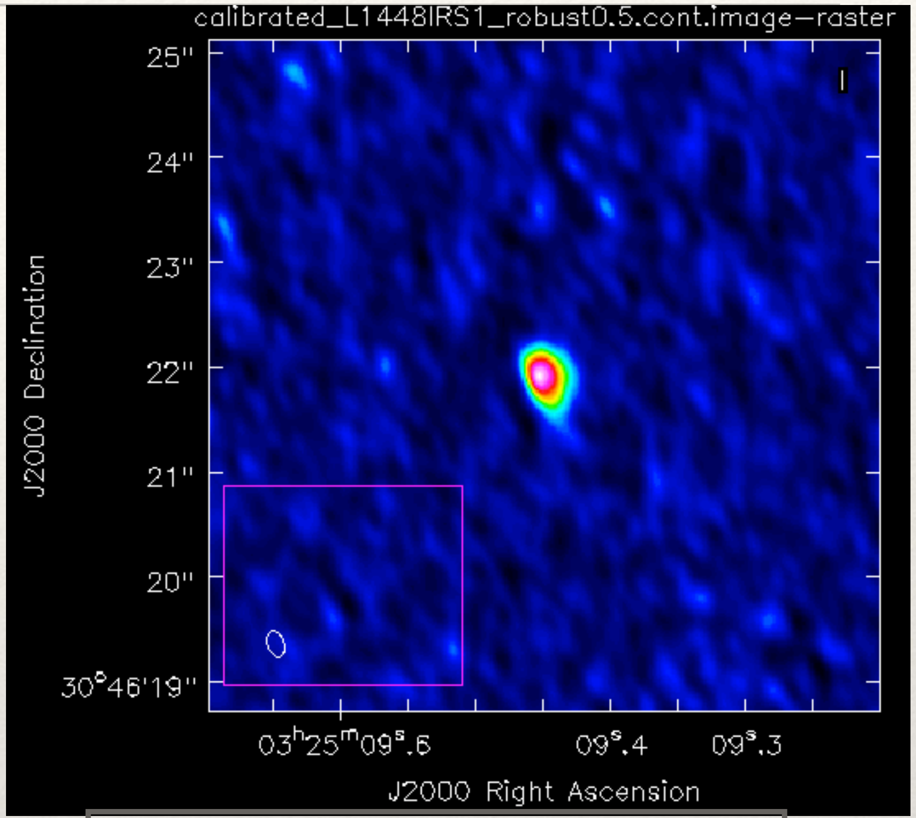
rms~2.2e-2 mJy/beam/ch



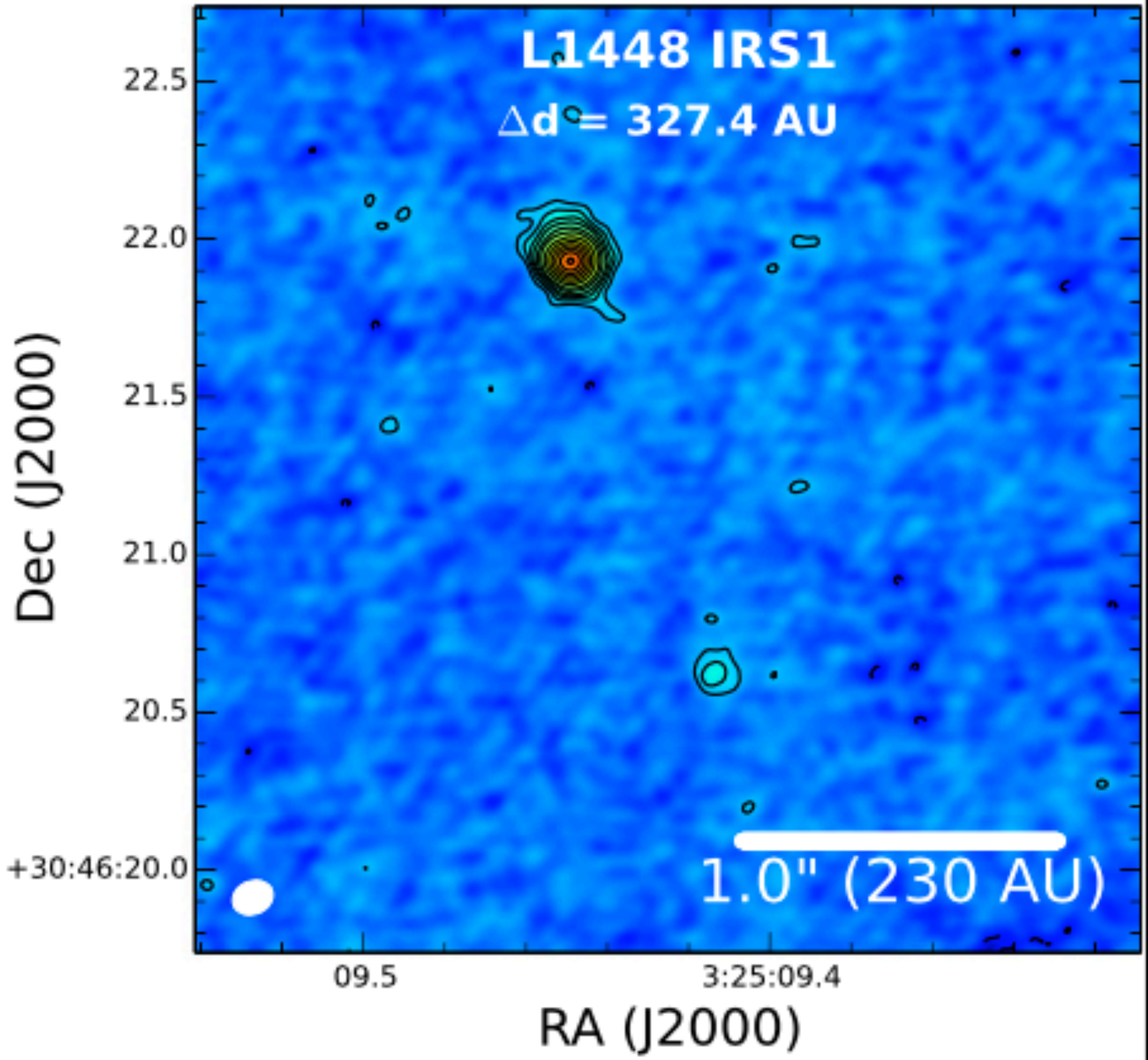
Maj, Min = 0.58″, 0.38″
rms~6.7e-4 mJy/beam
Flux_peak~0.02 Jy/beam
Flux_int~0.07 Jy

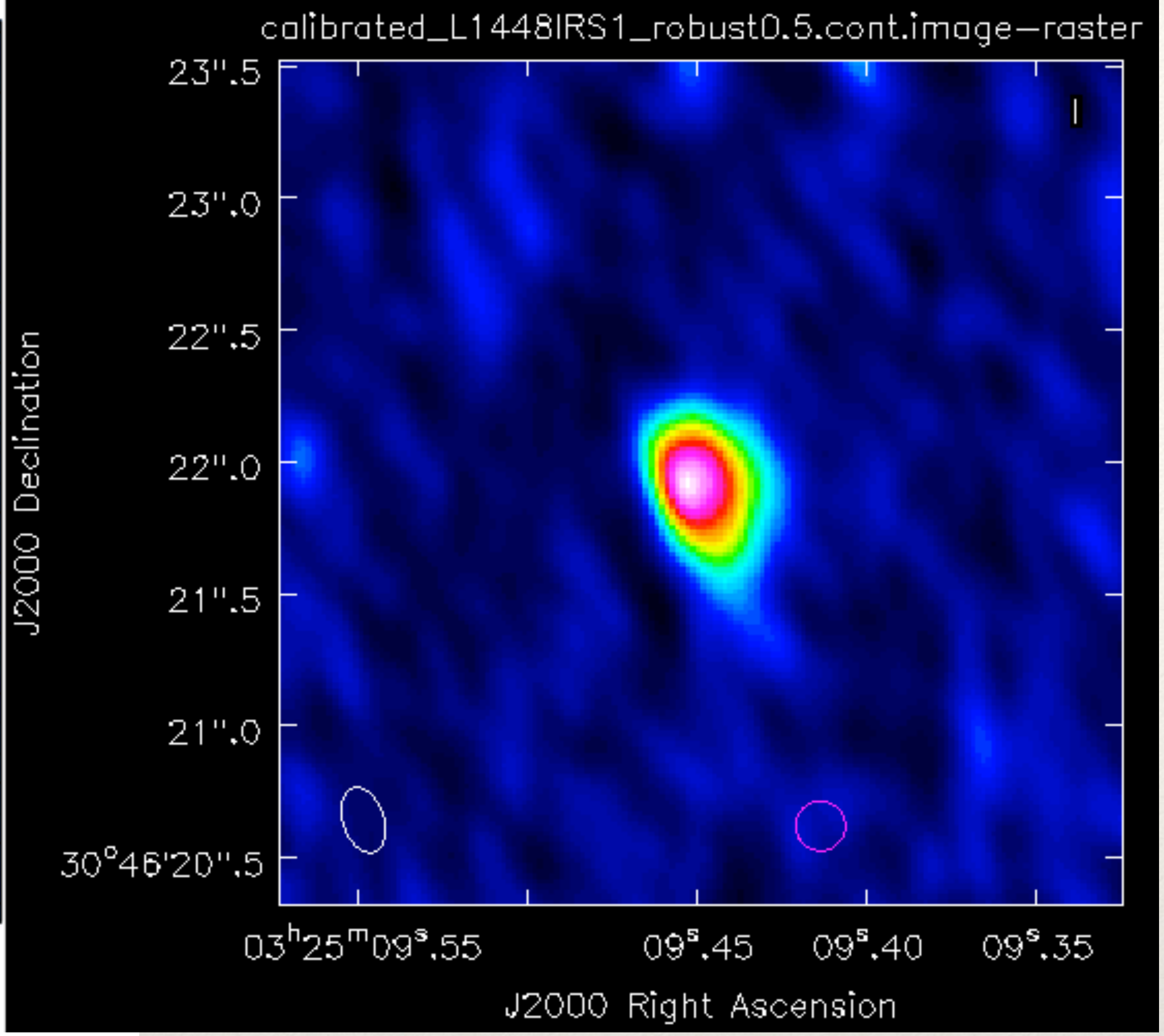


Maj, Min = 0.53″, 0.34″
rms~5.9e-4 mJy/beam
Flux_peak~0.02 Jy/beam
Flux_int~0.06 Jy



Maj, Min = 0.51″, 0.33″
rms~5.5e-4 mJy/beam
Flux_peak~0.01 Jy/beam
Flux_int~0.06 Jy





L1448IRS1-A	03:25:09.449	+30:46:21.924
L1448IRS1-B	03:25:09.413	+30:46:20.625

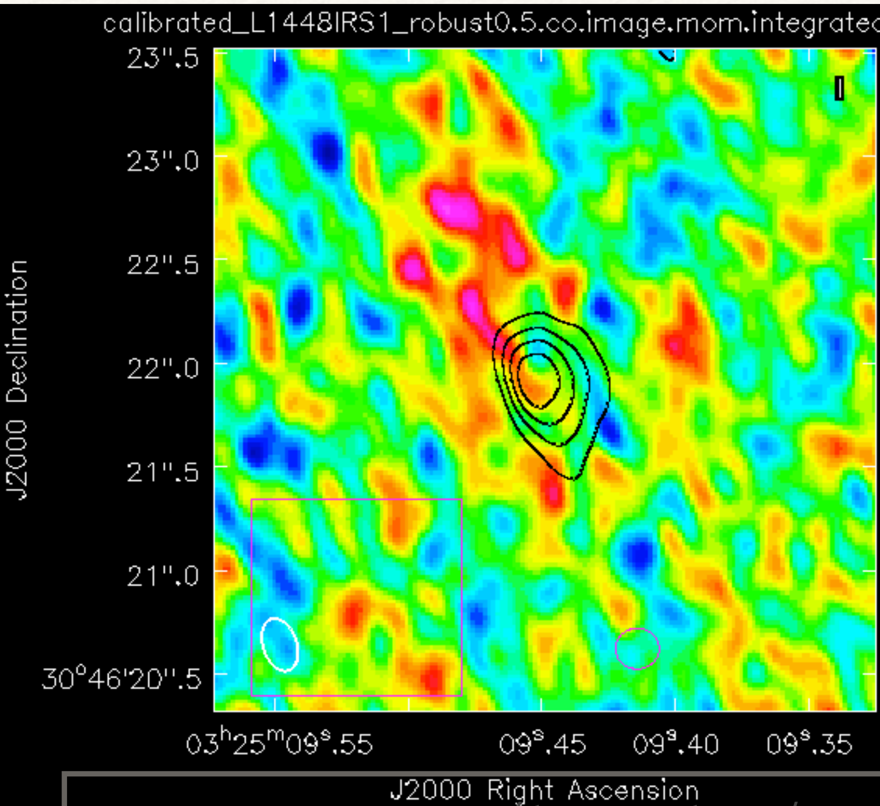
Maj, Min = 0.51″, 0.33″
rms~5.5e-4 mJy/beam
Flux_peak~0.01 Jy/beam
Flux_int~0.06 Jy

Class I Multiple Systems

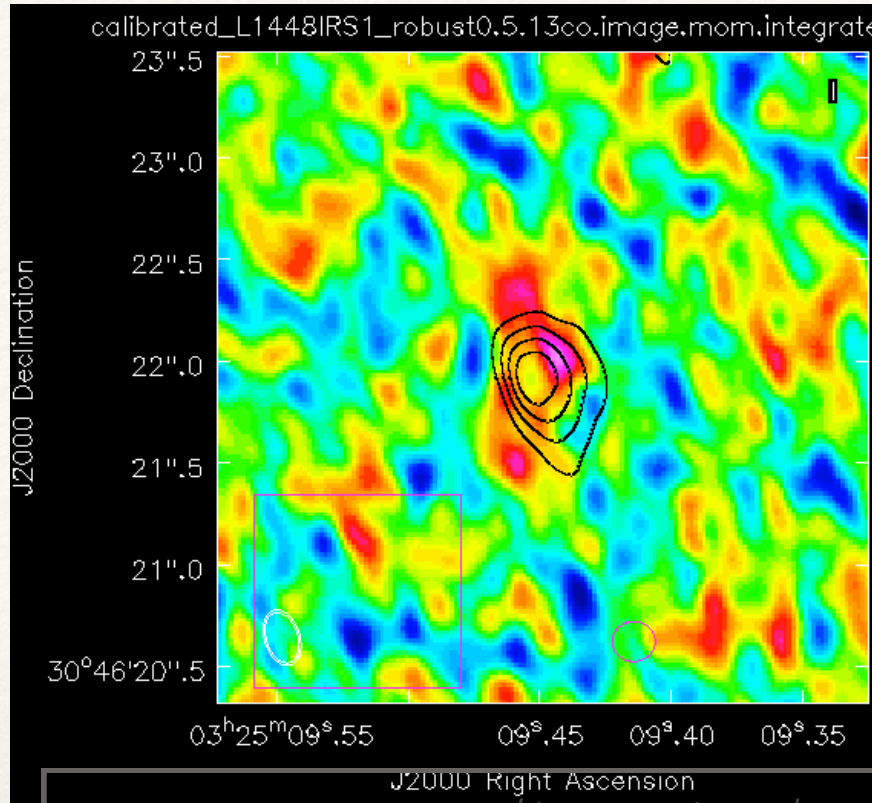
Source	Separation ($''$)	Separation (au)	Flux Differencep (Log $[F_1/F_2]$)
L1448IRS1	1.424 ± 0.015	327.4 ± 3.5	1.02 ± 0.09

radius = 0.2″
rms~6.5e-4 Jy/beam
Flux_peak~9.5e-4 Jy/beam
Flux_int~4.3e-4 Jy

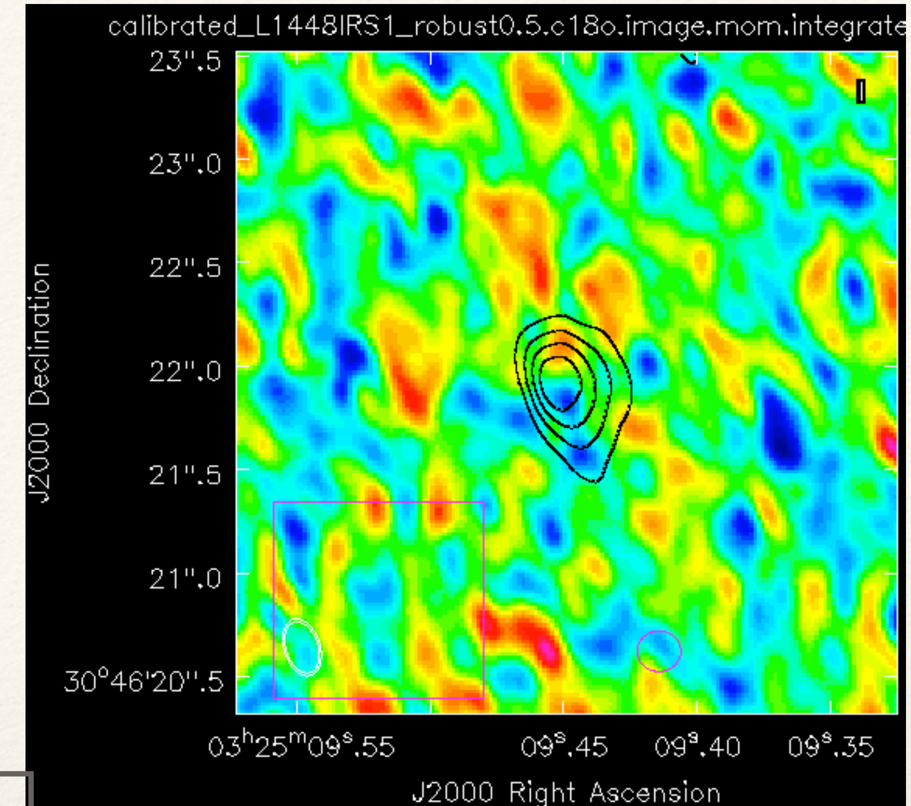
While we cannot reliably quantify our level of incompleteness, we do detect all the currently known infrared companions (i.e., EDJ2009-183 and L1448 IRS1 Connelley et al. 2008) and most millimeter companions (except for VeLLOs/candidate FHSCs). Furthermore, our observed CSF of Class I protostars



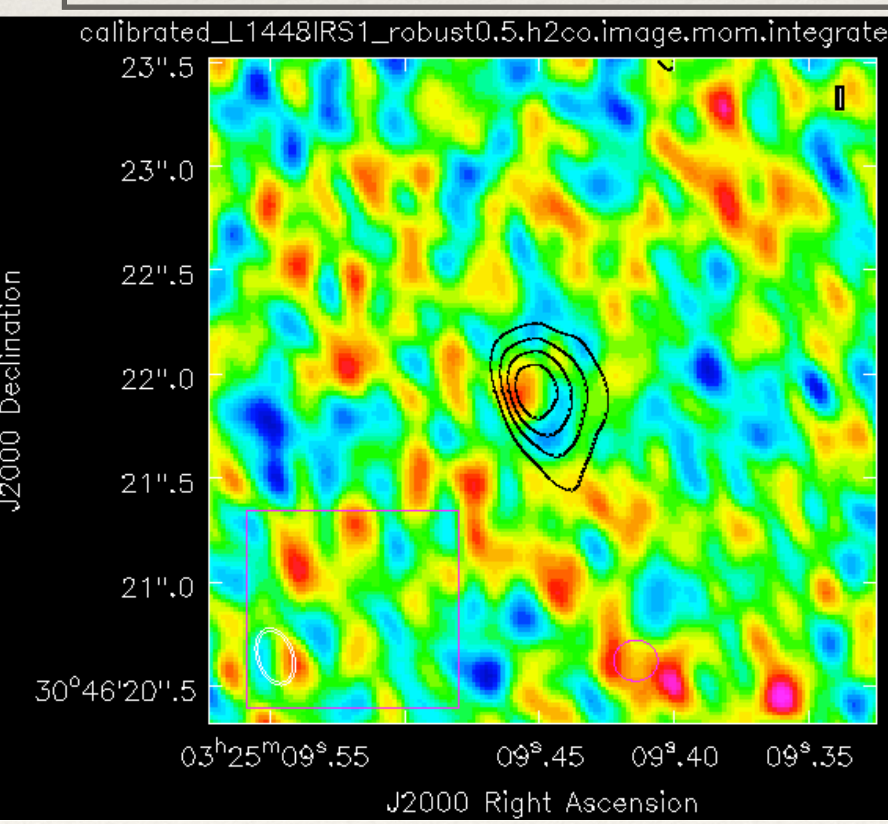
rms~8.3e-3 Jy/beam.km/s
Flux_peak~5e-2 Jy/beam.km/s



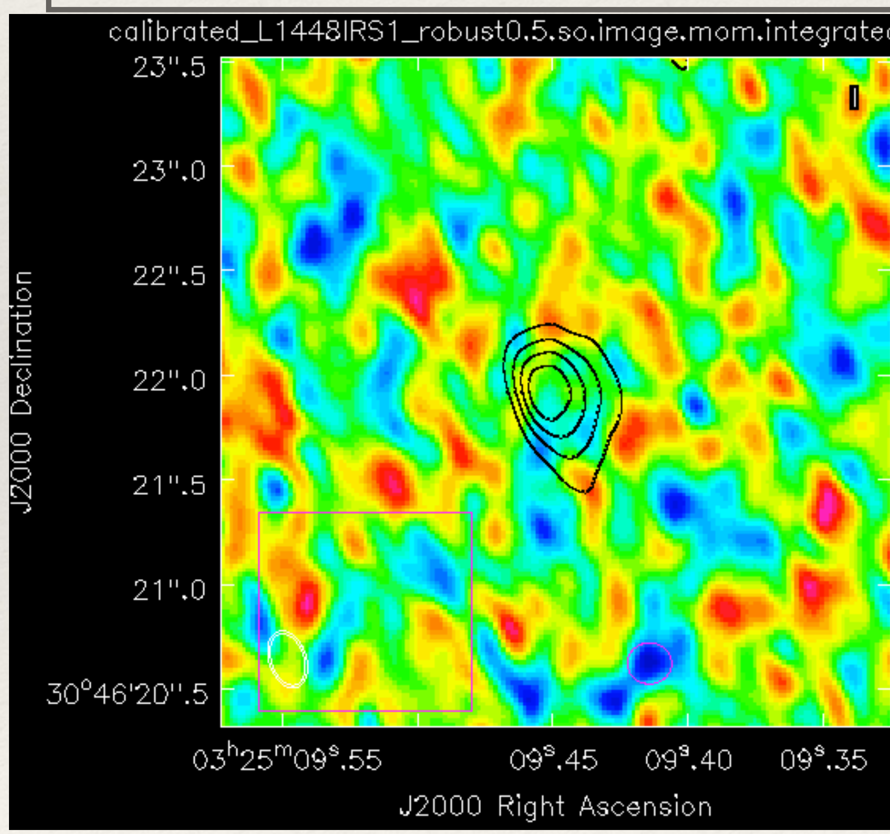
rms~6.7e-3 Jy/beam.km/s
Flux_peak~6.1e-2 Jy/beam.km/s



rms~1.1e-2 Jy/beam.km/s



rms~1.5e-2 Jy/beam.km/s



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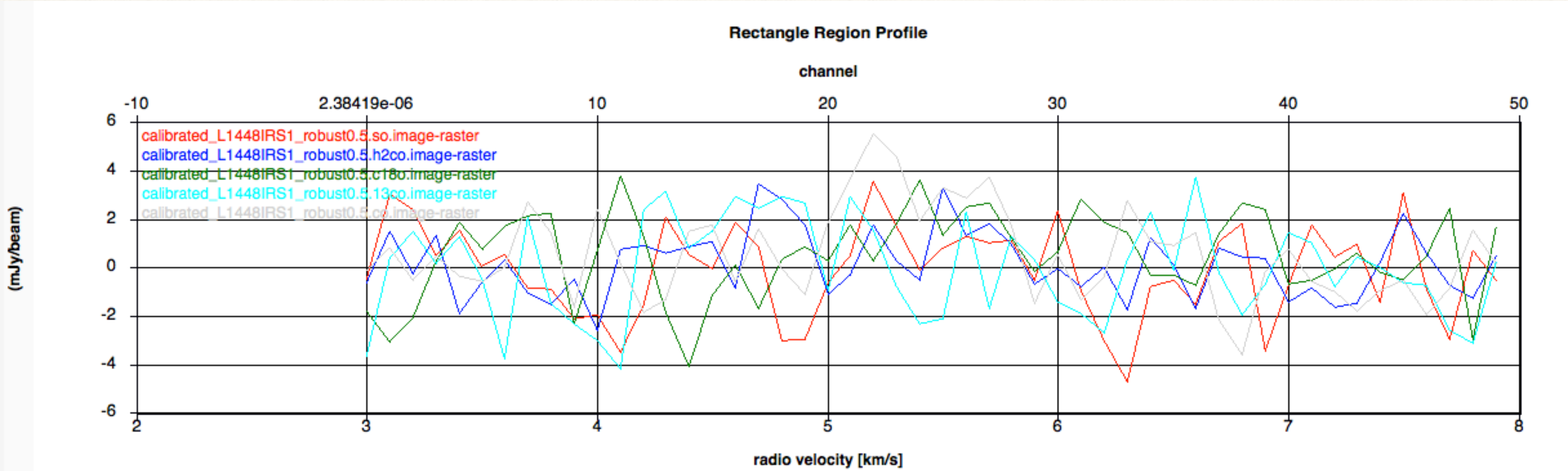
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3
4
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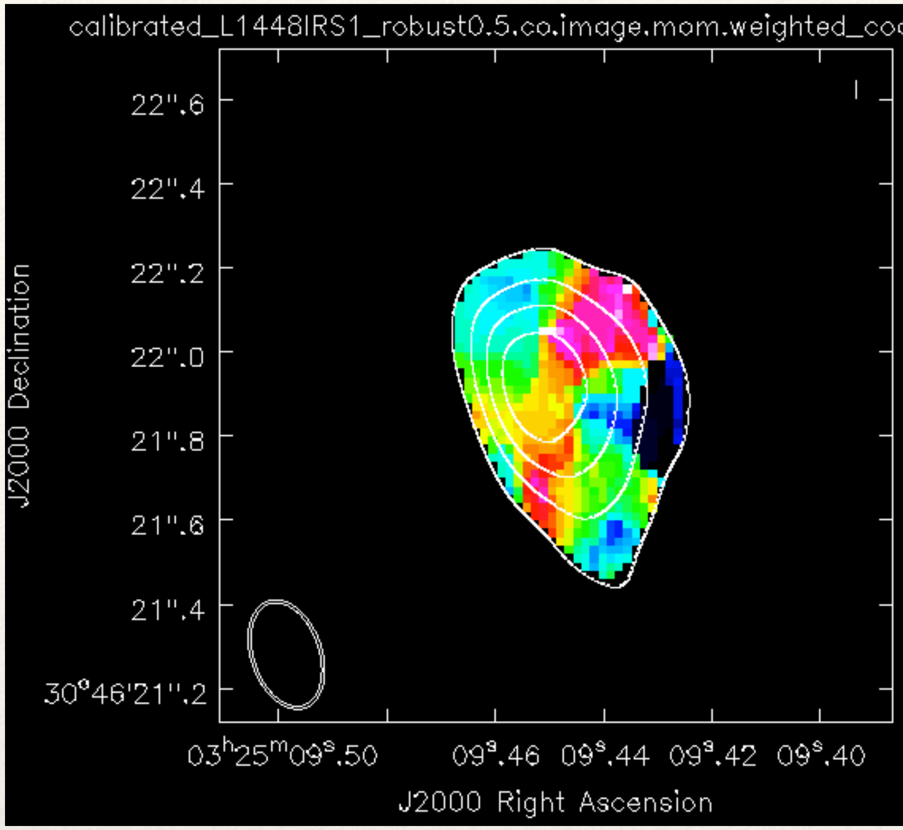
7
8
radio velocity [km/s]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22''.6
22''.4
22''.2
22''.0
21''.8
21''.6
21''.4
30°46'21''.2
J2000 Declination
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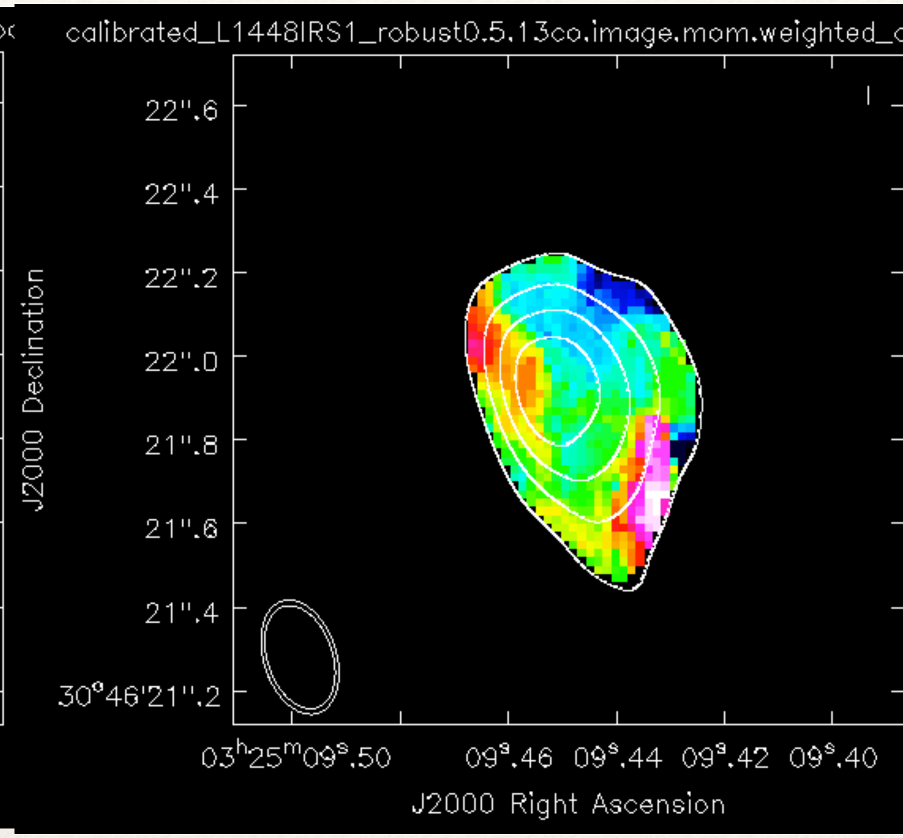
09s.46
09s.44
09s.42
09s.40
J2000 Right Ascension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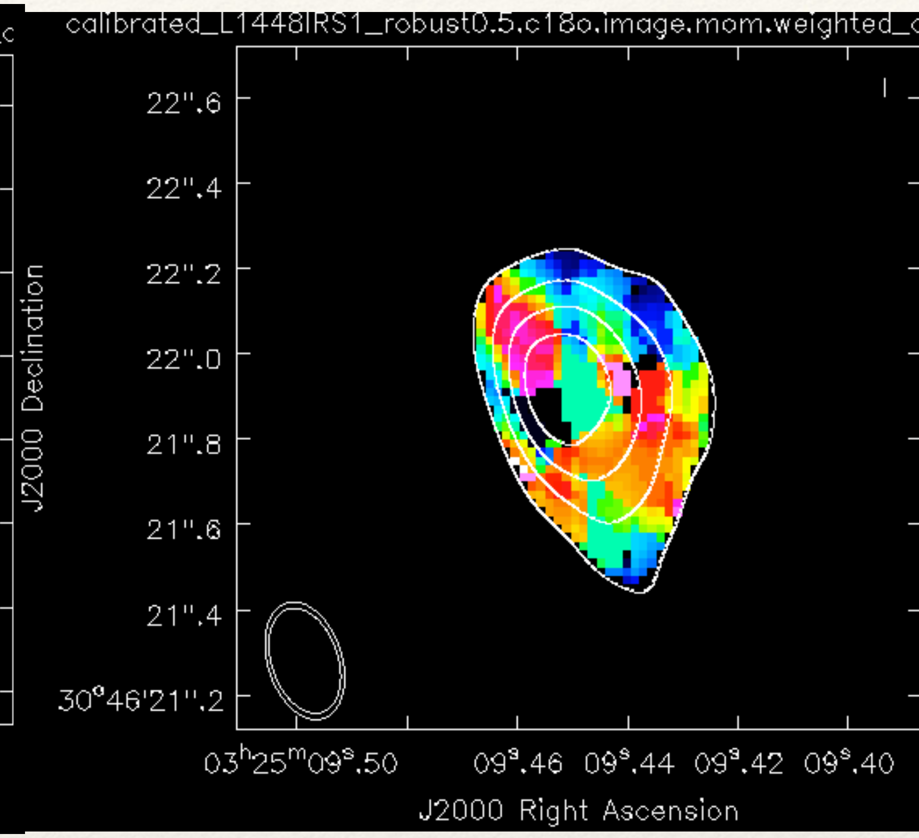
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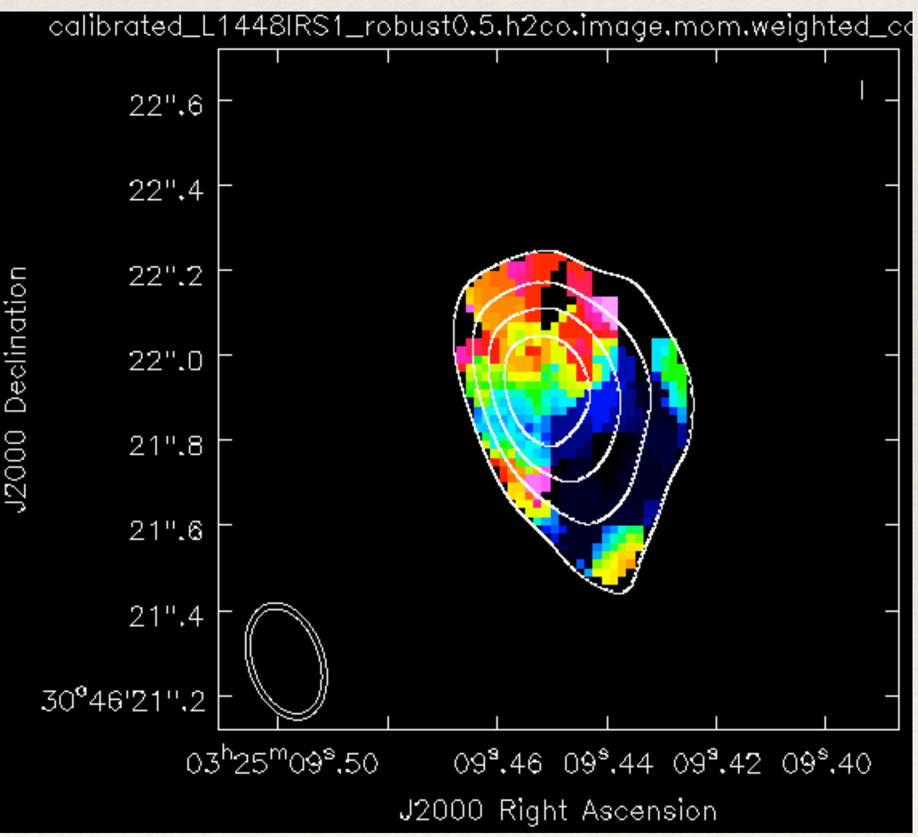
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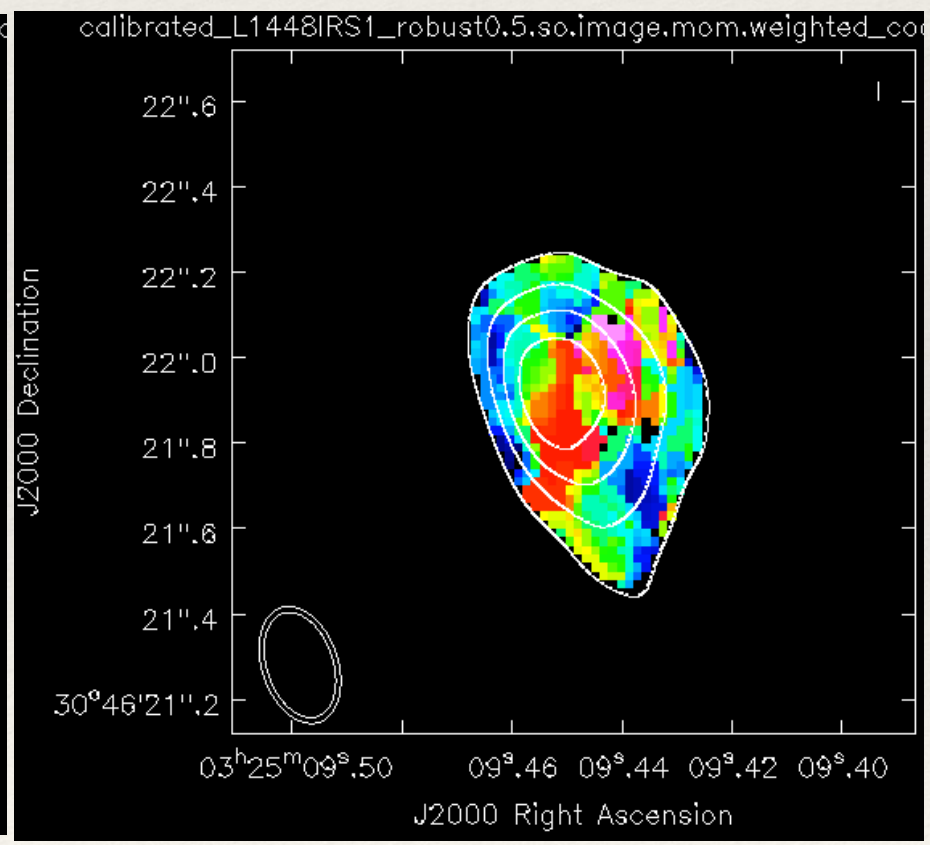
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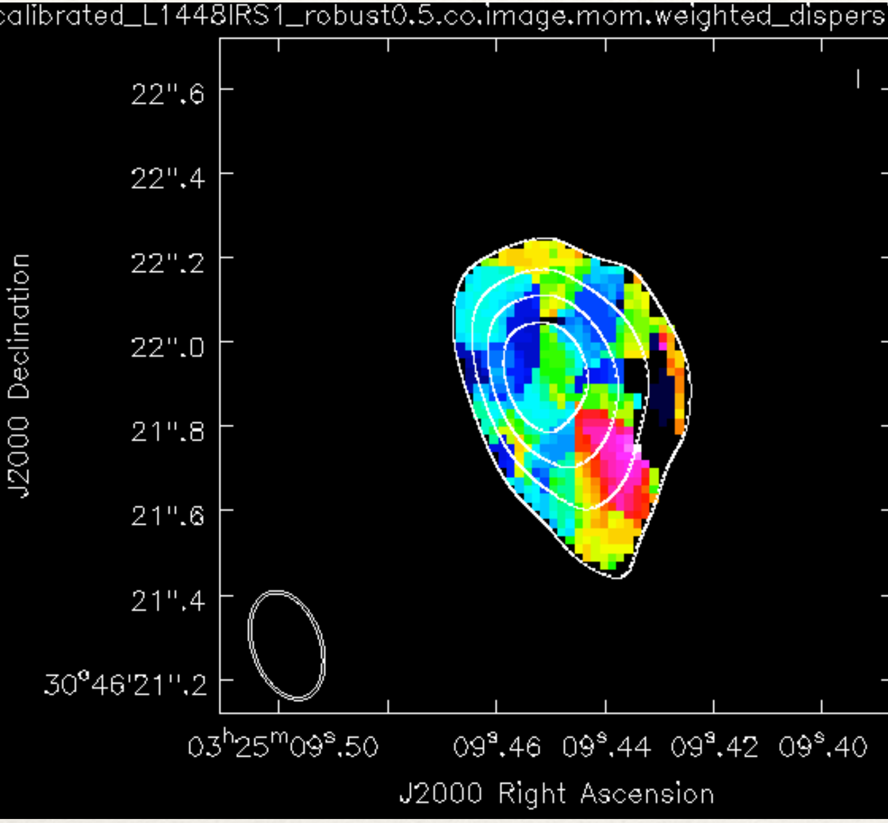
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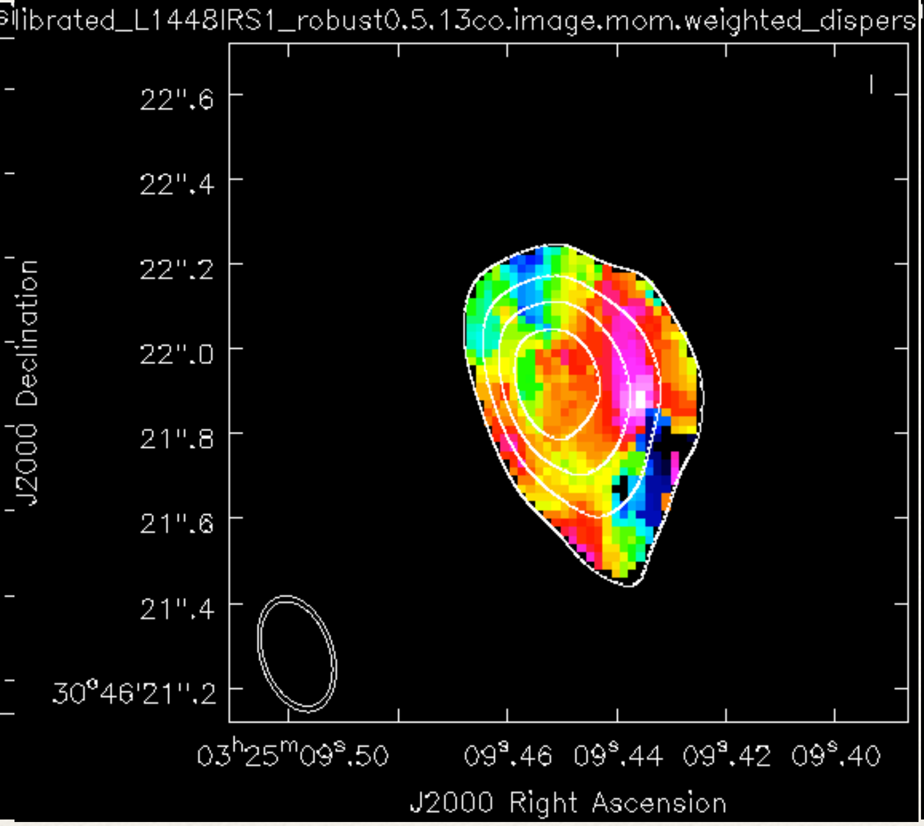
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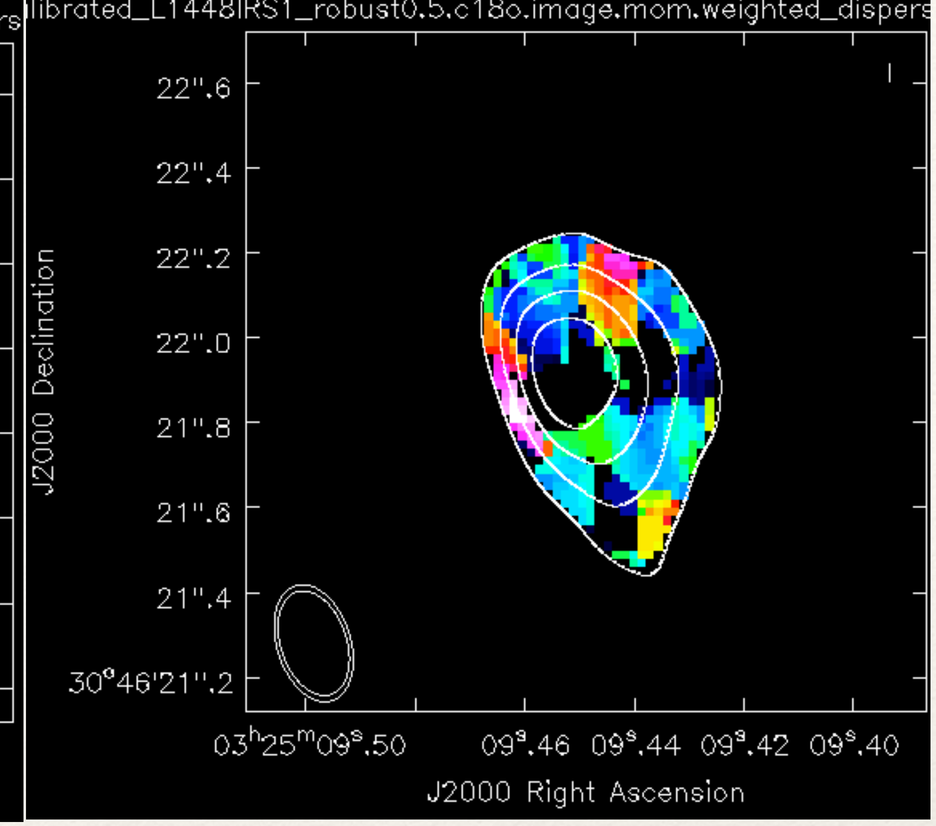
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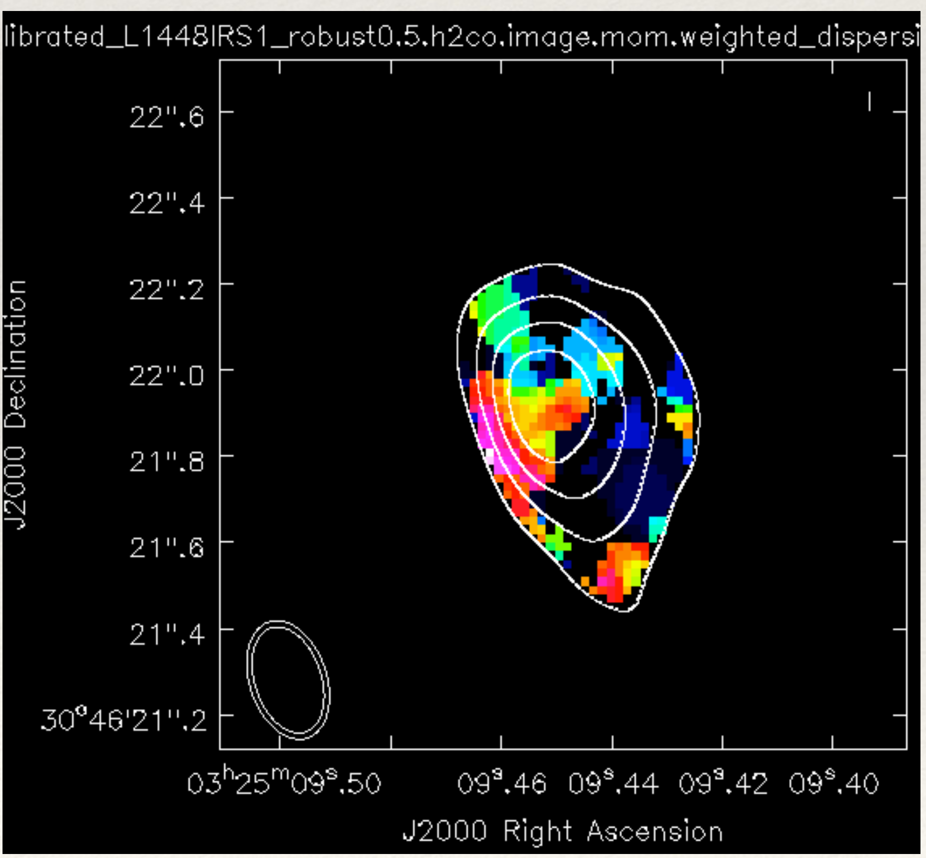
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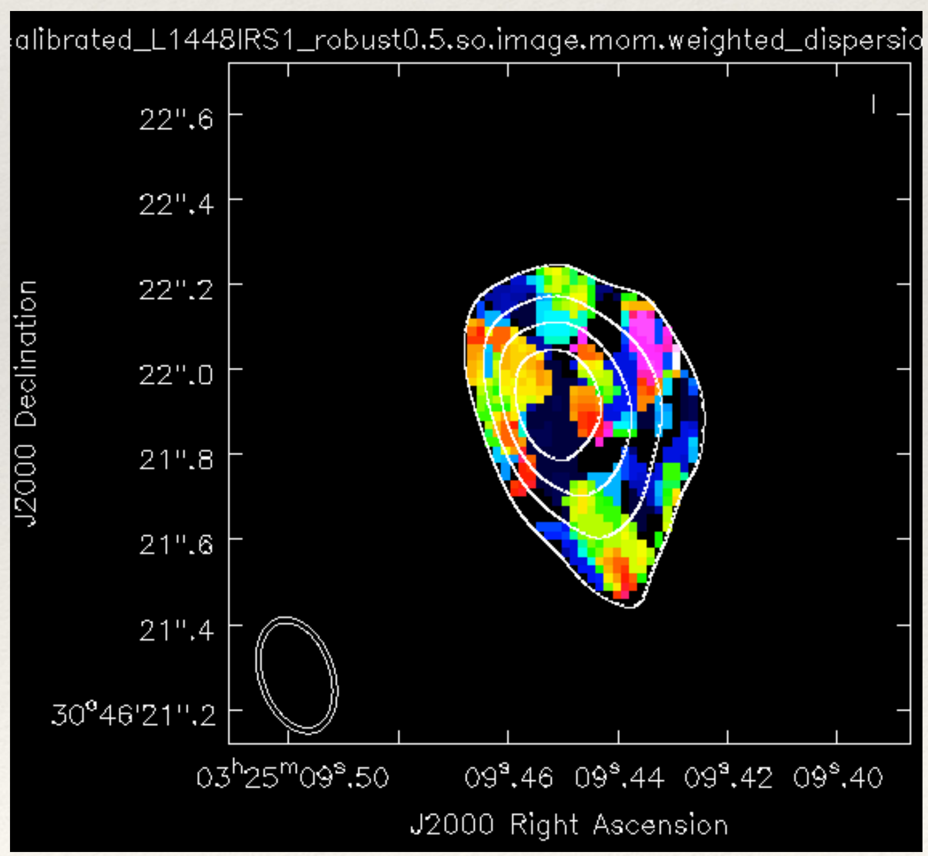
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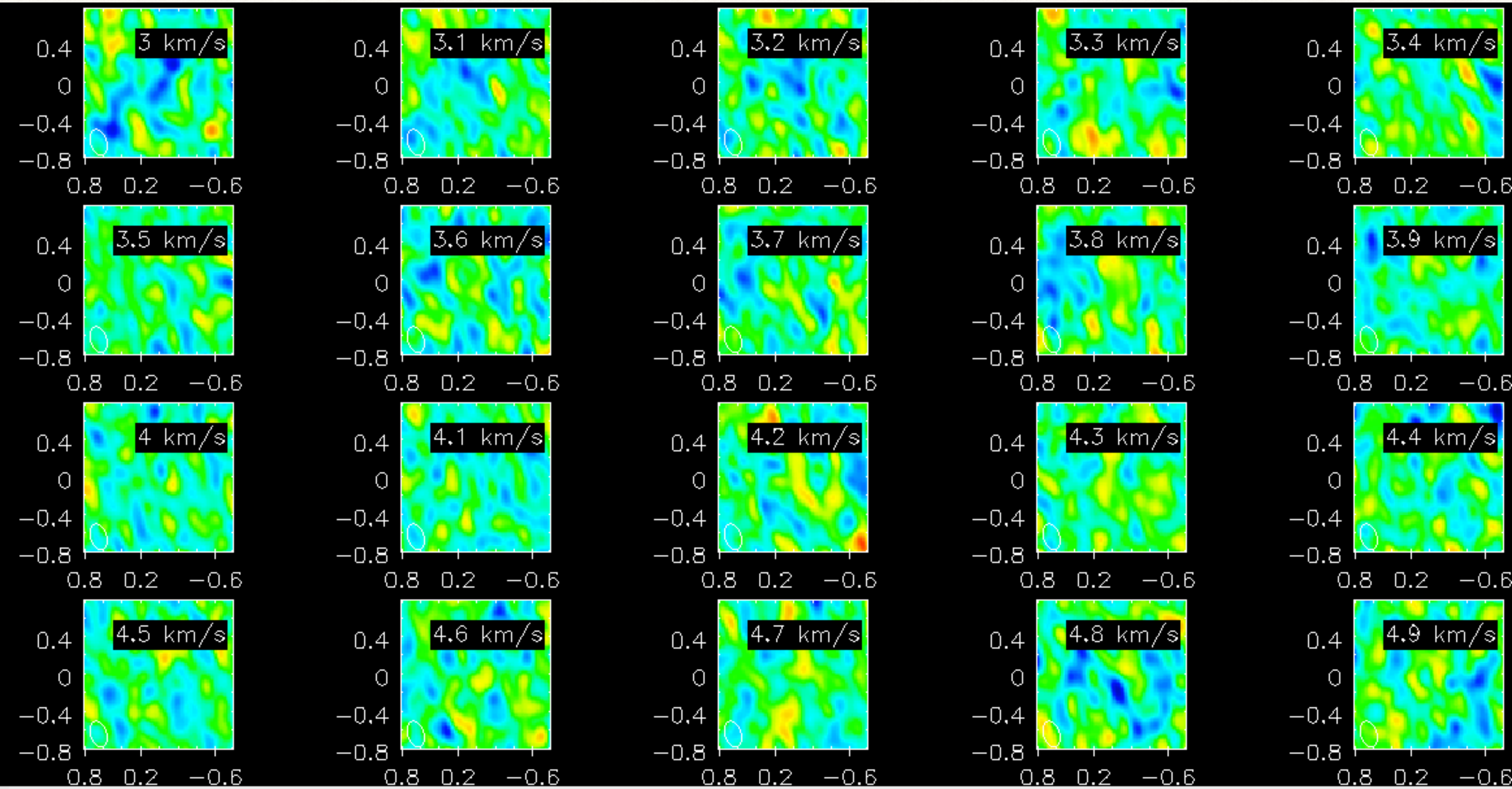
J2000 Right Ascension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