Effelsberg-Bonn HI Survey (EBHIS)

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To make an all-sky survey of Galactic 21-cm emission with a 100m-class telescope has been a dream for many decades, now the dream is finally coming true.

anonymous referee

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- 7-beam receiver system
- On-the fly observing mode
- Fully sampled sky coverage above Dec = -5º
- EBHIS observations started in August 2008
- **First full sky coverage finished in April 2013!**

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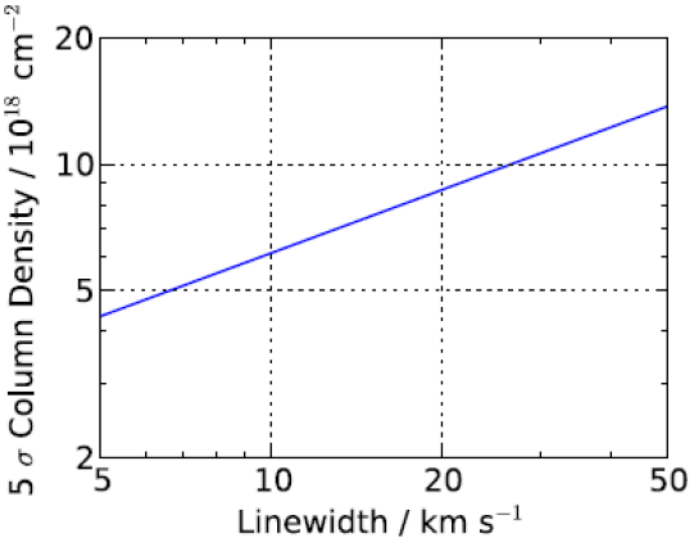
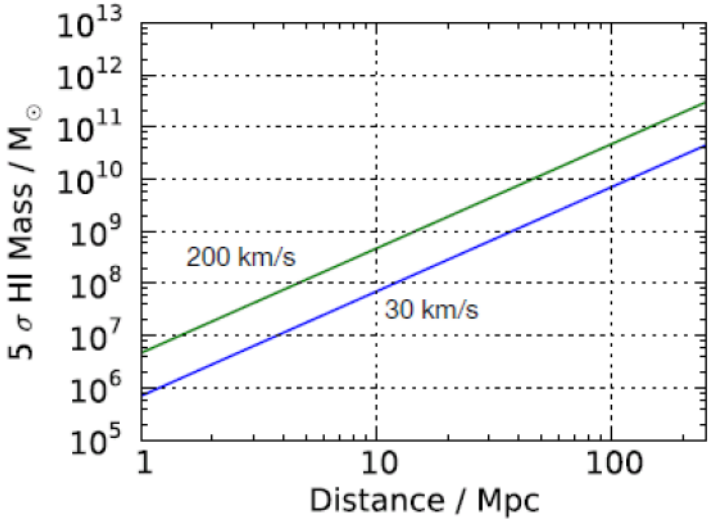
EBHIS concept

- **Galactic and extragalactic HI survey in parallel**:
  - **21.400 square degrees**
  - **100 MHz bandwidth z ≤ 0.07 (270 Mpc)**
  - 14 spectrometer with **16384** spectral channels each
  - High angular resolution → fully sampled grid 1/44 LAB
  -





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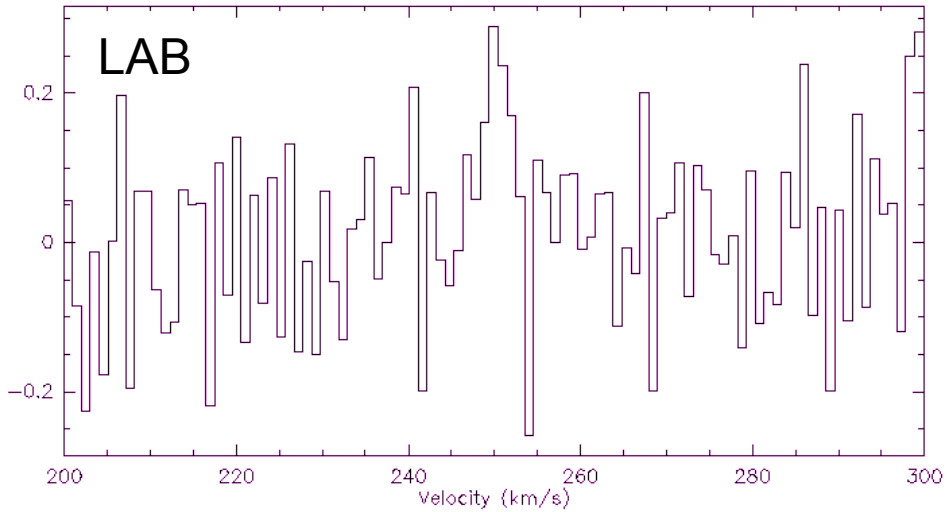
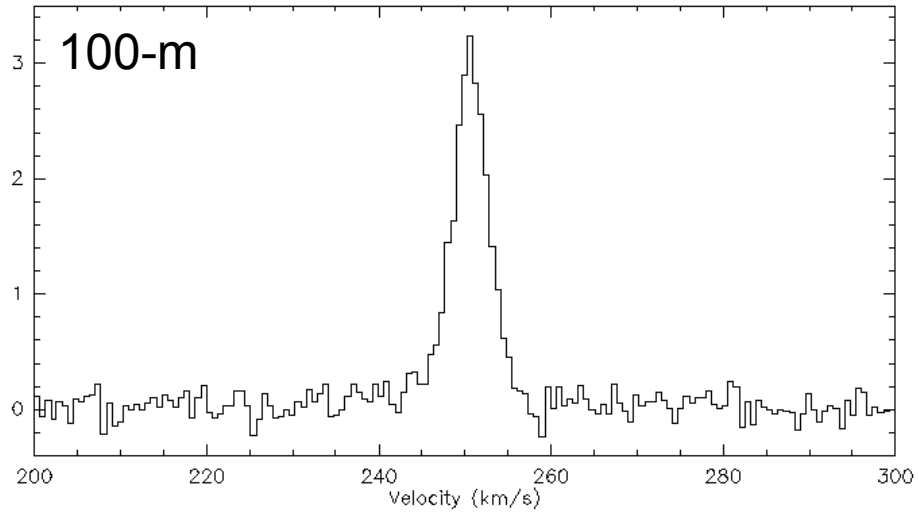
EBHIS concept



HVC 289+33+251

Brüns & Westmeier 2004, A&A 426, L9



Beam filling is different !

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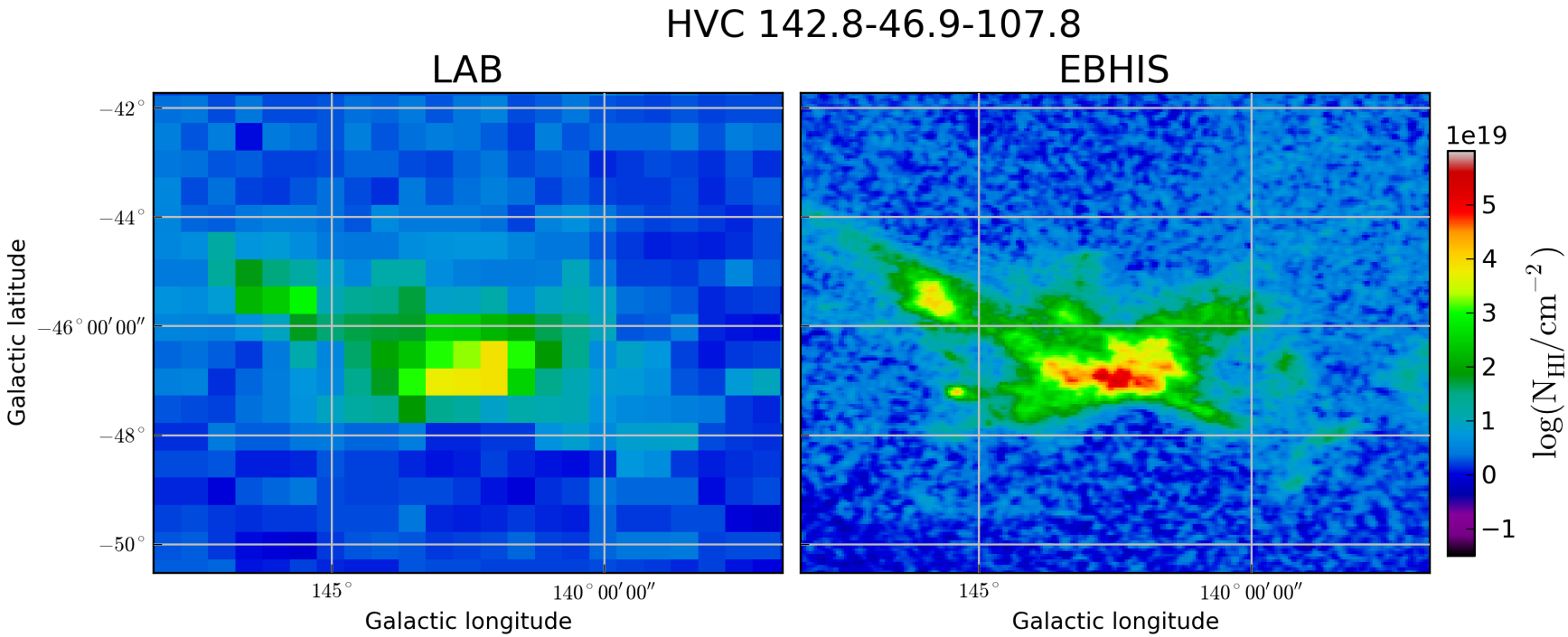
EBHIS concept



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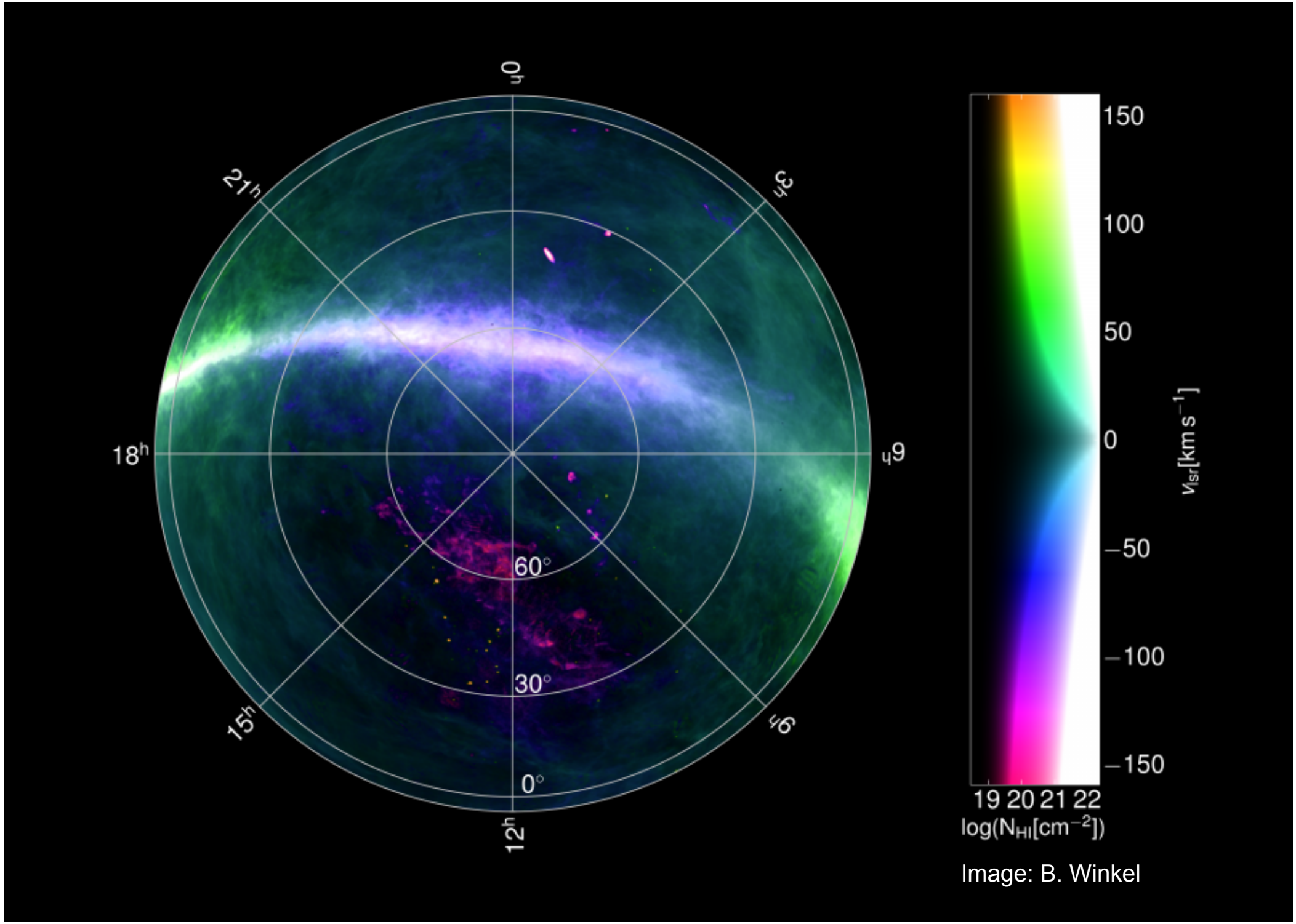

Image: B. Winkel

EBHIS: extragalactic science prospects

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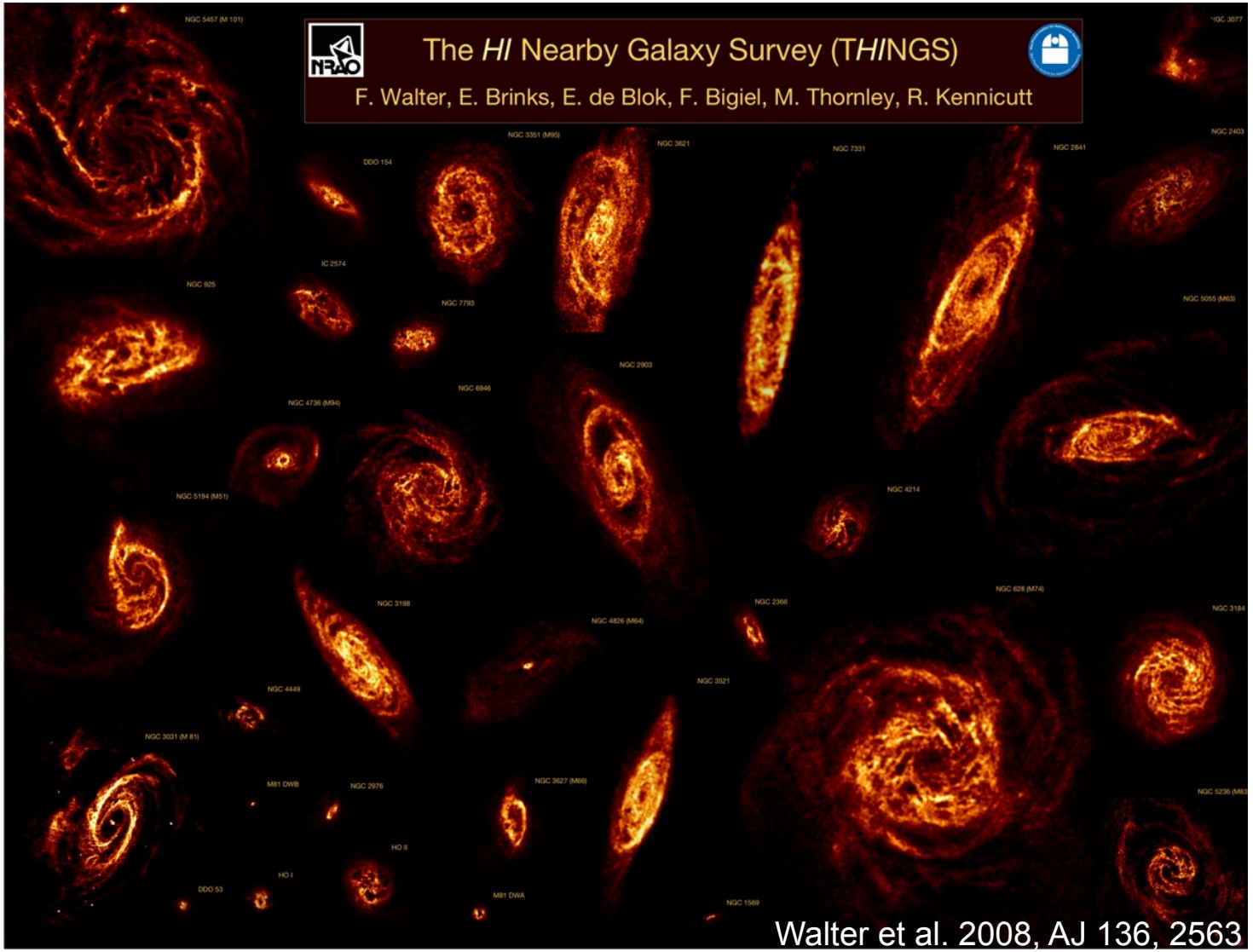
EBHIS "The HI Nearby Galaxy Survey"



Walter et al. 2008, AJ 136, 2563

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EBHIS: THINGS ensemble

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confused with M.W.										
NGC 1569	04:30:49	64:50:53	2.0	44.3/0.42	-.-/-.-	42	22.7	-.-	-.-	g
NGC 2366	07:28:53	69:12:51	3.4	241/6.57	267/7.28	35.6	3.3	-.-	> 135*	
NGC 2403	07:36:51	65:36:03	3.2	-.-/-.-	1145/27.67	39.2	98.6	100	310	g
M81A	08:23:56	71:01:45	3.6	8.1/0.25	4.5/0.14	11	6.1	110*	27*	g
DDO53	08:34:07	66:10:54	3.6	12.4/0.38	21.8/0.67	21	6.1	-.-	-.-	g
NGC 2976	09:47:15	67:55:00	3.6	36.7/1.12	100*/3.06	40.5	1.0	3.5	133	g
NGC 3031	09:55:33	69:03:55	3.6	2688.2/82.2	2626/80.3	111.6	15.3	-8.5	667	
NGC 3077	10:03:19	68:44:02	3.8	> 385/> 13.2	393.6/13.4	17.4	-.-	-16	170	g
IC2574	10:28:27	68:24:59	4.0	349.6/13.20	395.5/14.93	36	17.1	> 100	-.-	
NGC 4449	12:28:12	44:05:40	4.2	593/24.7	457/19.0	67.2	15.6	207	160	g
NGC 6946	20:34:52	60:09:14	5.9	434.9/35.7	713.2/58.6	55.2	23.4	63.7	151	g
separated f. M.W.										
NGC 628	01:36:42	15:47:00	7.3	403.8/50.5	400.9/50.4	42.6	26.4	651	83	g
NGC 925	02:27:16	33:34:44	9.2	198.0/39.6	207.8/41.5	29.4	92.2	546	218	g
HoII	08:19:05	70:43:12	3.4	269.5/7.35	279.8/7.63	36	6.2	160.0	53.7	g
NGC 2841	09:22:03	50:58:35	14.1	192.6/90.37	192.3/90.23	35.5	145.0	641	578	
HoI	09:40:32	71:10:56	3.8	39.6/1.35	39.7/1.35	26	5.2	146.9	23.6	
NGC 3184	10:18:17	41:25:28	11.1	105.1/30.6	100.5/29.2	42.2	34.9	593	129	
NGC 3198	10:19:55	45:32:59	13.8	236.5/106.3	238.3/107.1	40.5	147.0	660	303	
NGC 3351	10:43:58	11:42:14	10.1	232.5/56.0	397.2/95.6	25.2	79.4	836	410	g
NGC 3521	11:05:49	-00:02:09	10.7	244.8/66.1	309.1/83.5	39.1	113.5	781	422	
NGC 3627	11:20:15	12:59:30	9.3	117.8/24.1	119.5/24.4	36.0	139.0	712	313	g
NGC 4214	12:15:39	36:19:37	2.9	323/6.4	272/5.4	34.2	14.9	299	97	g
NGC 4736	12:50:53	41:07:13	4.7	95.7/5.0	106.3/5.5	47.4	12.5	334	170	g
DDO154	12:54:06	27:09:10	4.3	151/6.6	135/5.9	28	7.0	373	87.8	
NGC 4826	12:56:43	21:41:00	7.5	53.5/7.1	57.6/7.6	31.2	45.7	437	318	
NGC 5055	13:15:49	42:01:45	10.1	490.7/118.1	537.5/129.4	77.4	27.7	514	366	g
NGC 5194	13:29:52	47:11:43	8.0	279.7/42.2	286.6/43.2	53.6	45.3	465	169	g
NGC 5457	14:03:12	54:20:57	7.4	1680/217.1	1499.2/193.7	85.2	3.8	238	214	g
NGC 7331	22:37:04	34:24:57	14.7	437.6/222.2	395.7/201.8	73.2	117.8	823	496	g

Kerp et al. 2013, in prep.

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EBHIS: THINGS ensemble

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					confused with M.W.					
N					-.-/-.-	42	22.7	-.-	-.-	g
N					267/7.28	35.6	3.3	-.-	> 135*	
N					1145/27.67	39.2	98.6	100	310	g
N					4.5/0.14	11	6.1	110*	27*	g
I					21.8/0.67	21	6.1	-.-	-.-	g
N					100*/3.06	40.5	1.0	3.5	133	g
N					2626/80.3	111.6	15.3	-8.5	667	
N					393.6/13.4	17.4	-.-	-16	170	g
I					395.5/14.93	36	17.1	> 100	-.-	
N					457/19.0	67.2	15.6	207	160	g
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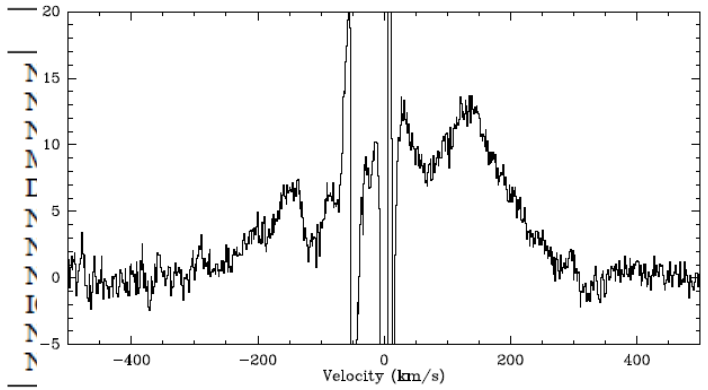
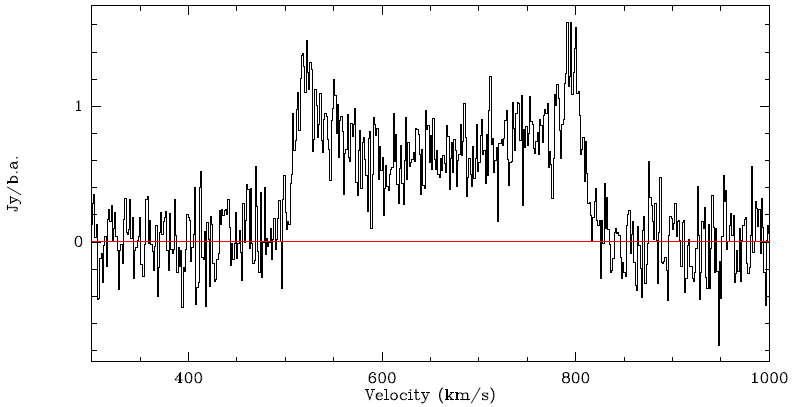


(f) NGC3031



(c) NGC3198

Kerp et al. 2013, in prep.

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NGC 6946	20:34:52	6						63.7	151	g
NGC 628	01:36:42	1						651	83	g
NGC 925	02:27:16	3						546	218	g
HoII	08:19:05	7						160.0	53.7	g
NGC 2841	09:22:03	5						641	578	
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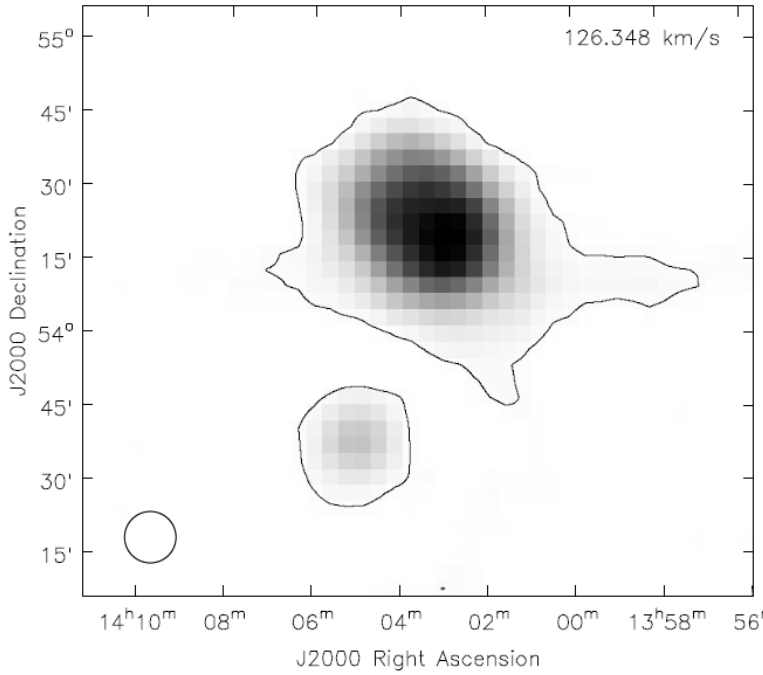

(a) NGC5457

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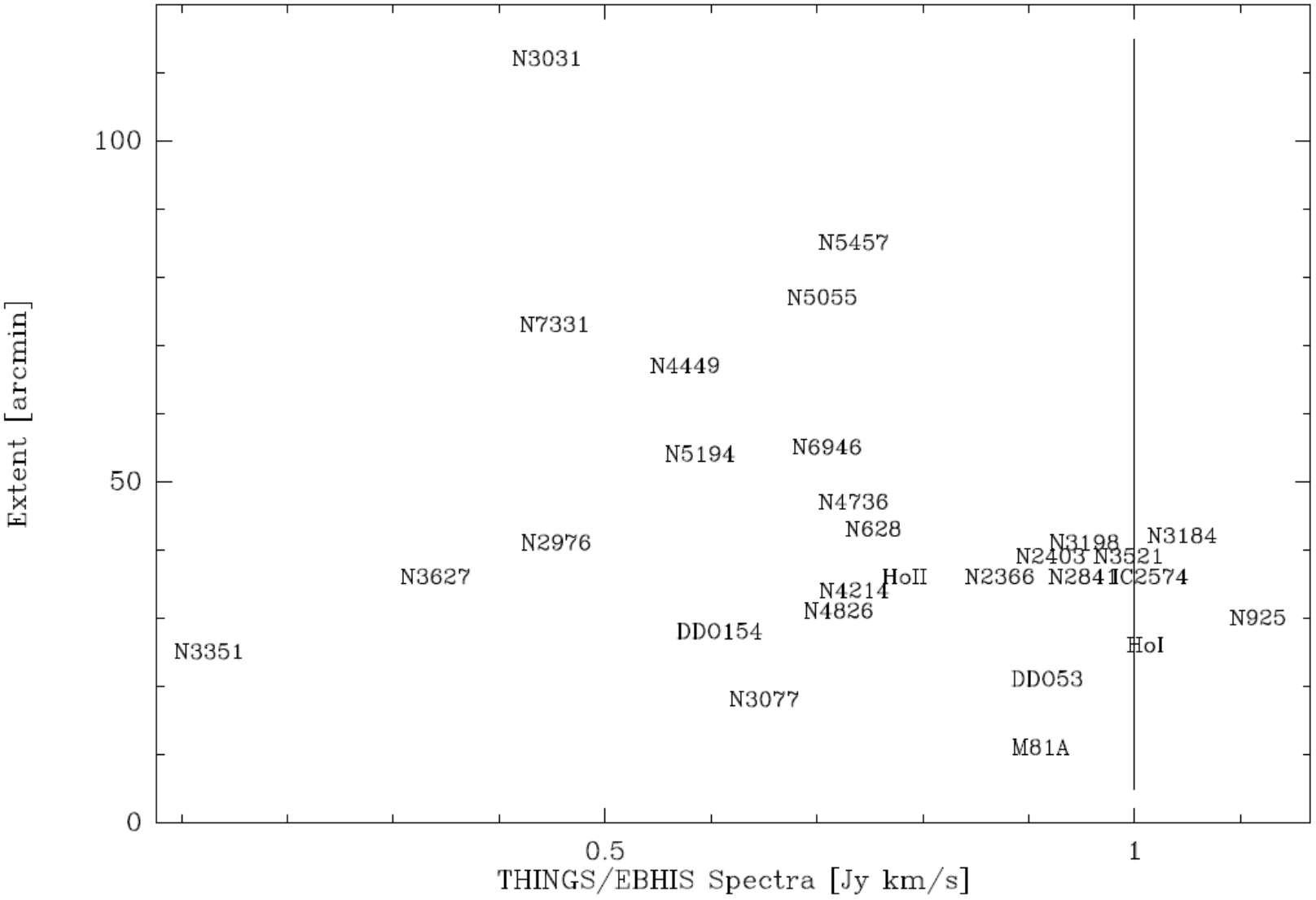
EBHIS vs. THINGS: flux comparison I



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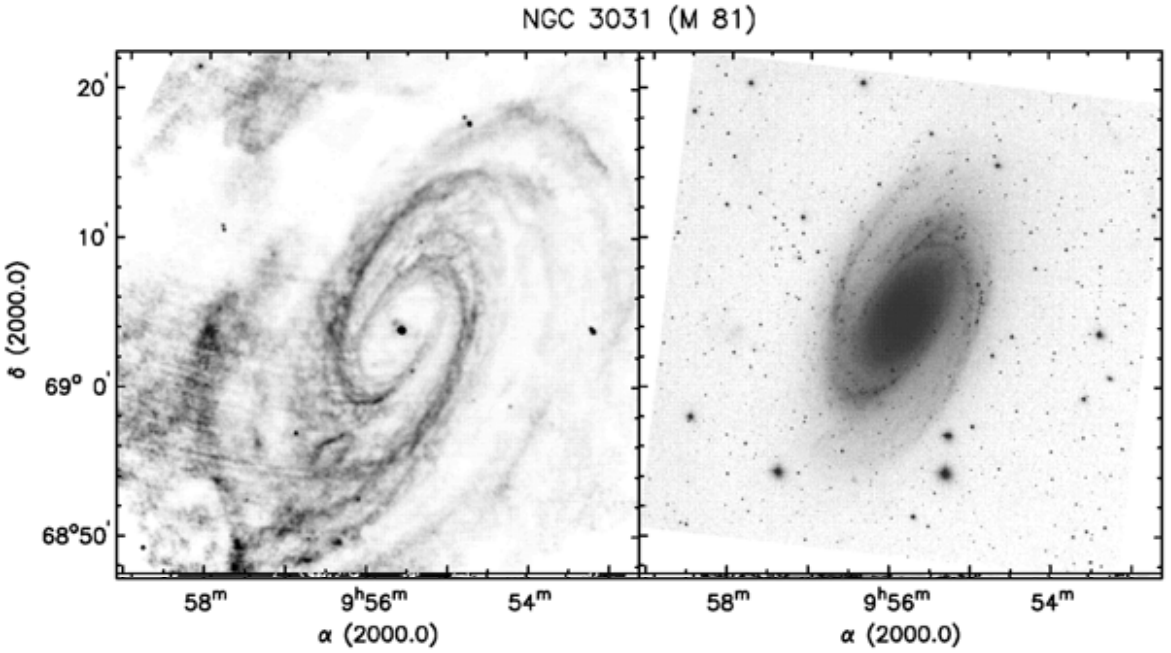
THINGS: NGC 3031 (M81)



Walter et al. 2008, AJ 136, 2563

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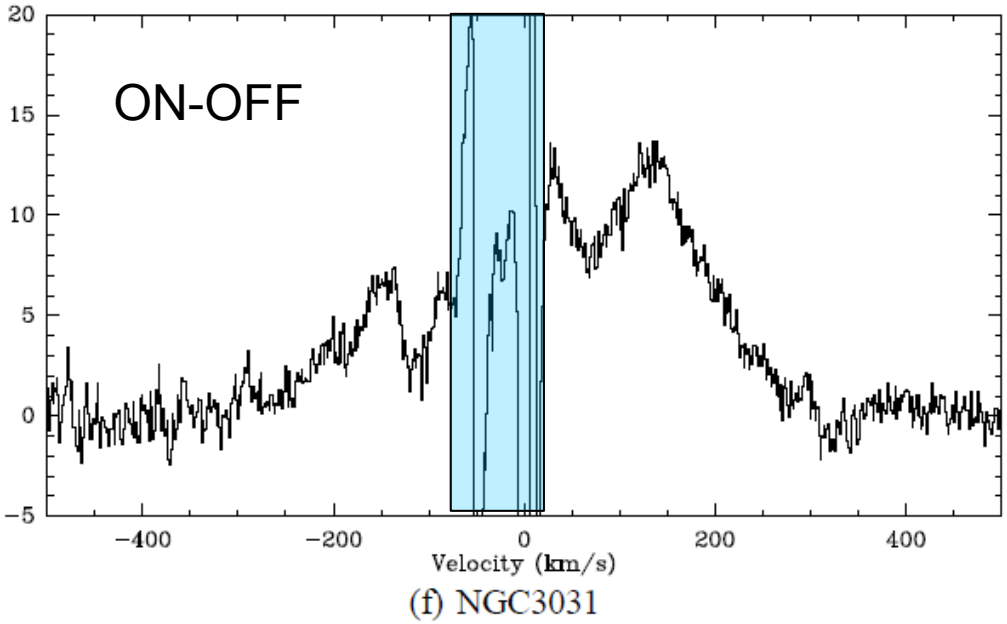
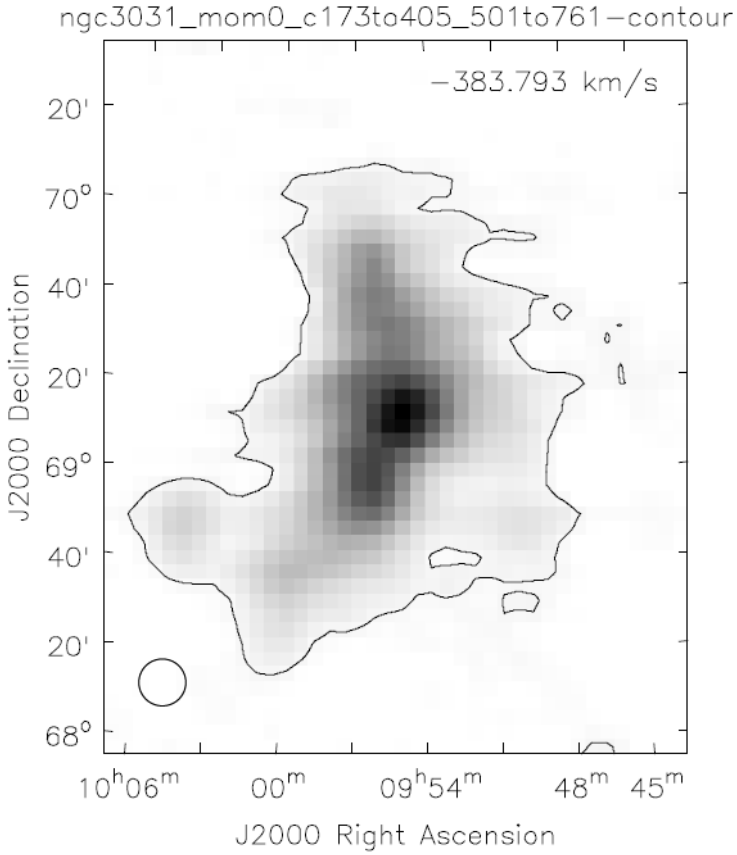
ETHINGS: NGC 3031 (M81)



(f) NGC3031



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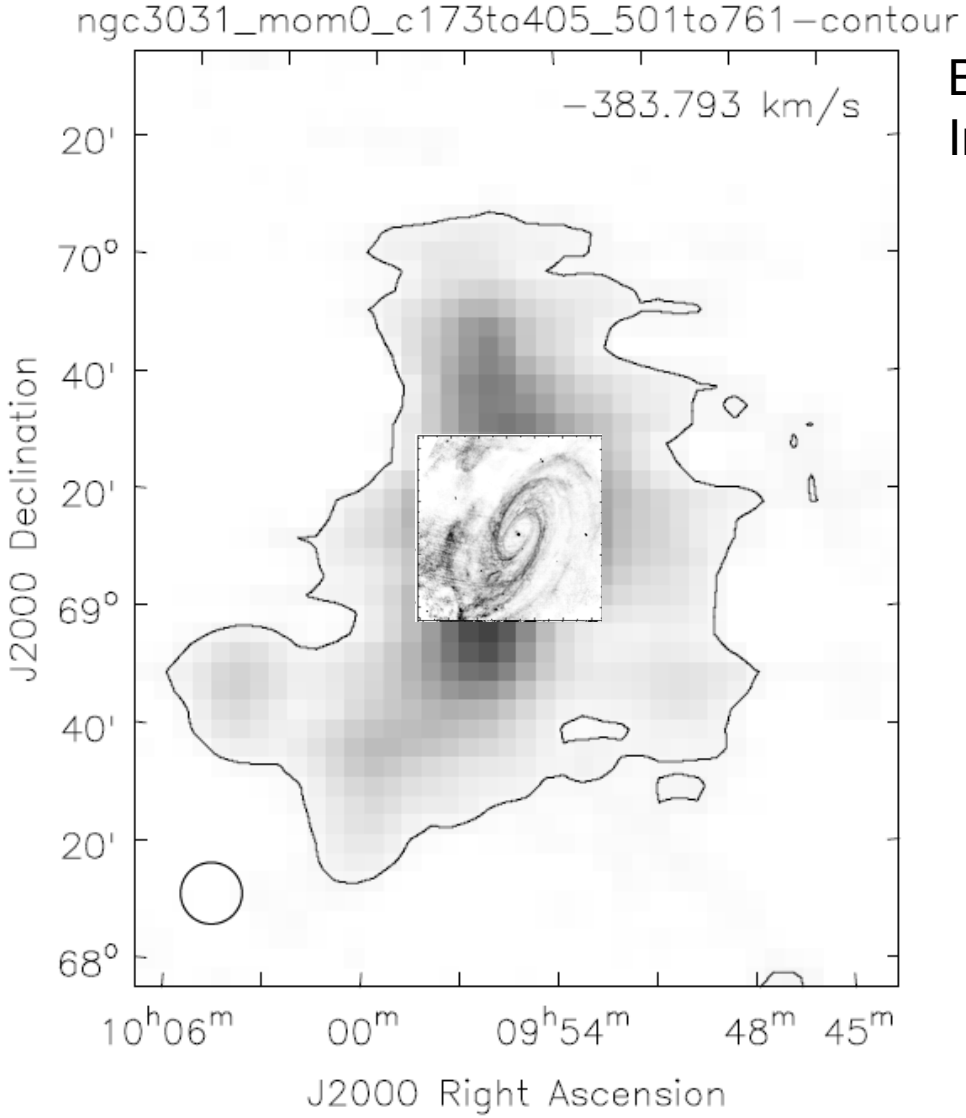

Background: EBHIS
Inset: THINGS

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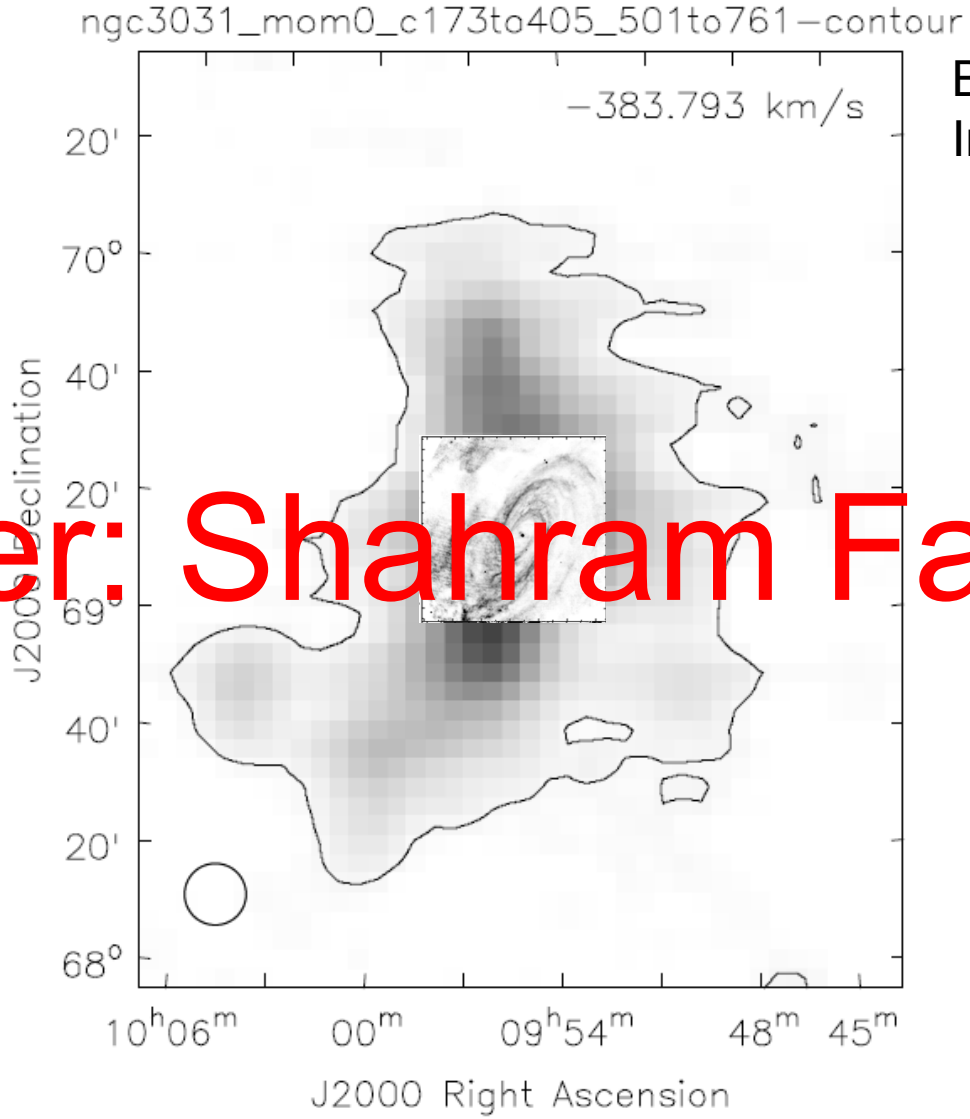
ETHINGS: NGC 3031 (M81)



Background: EBHIS
Inset: THINGS

Poster: Shahram Faridani

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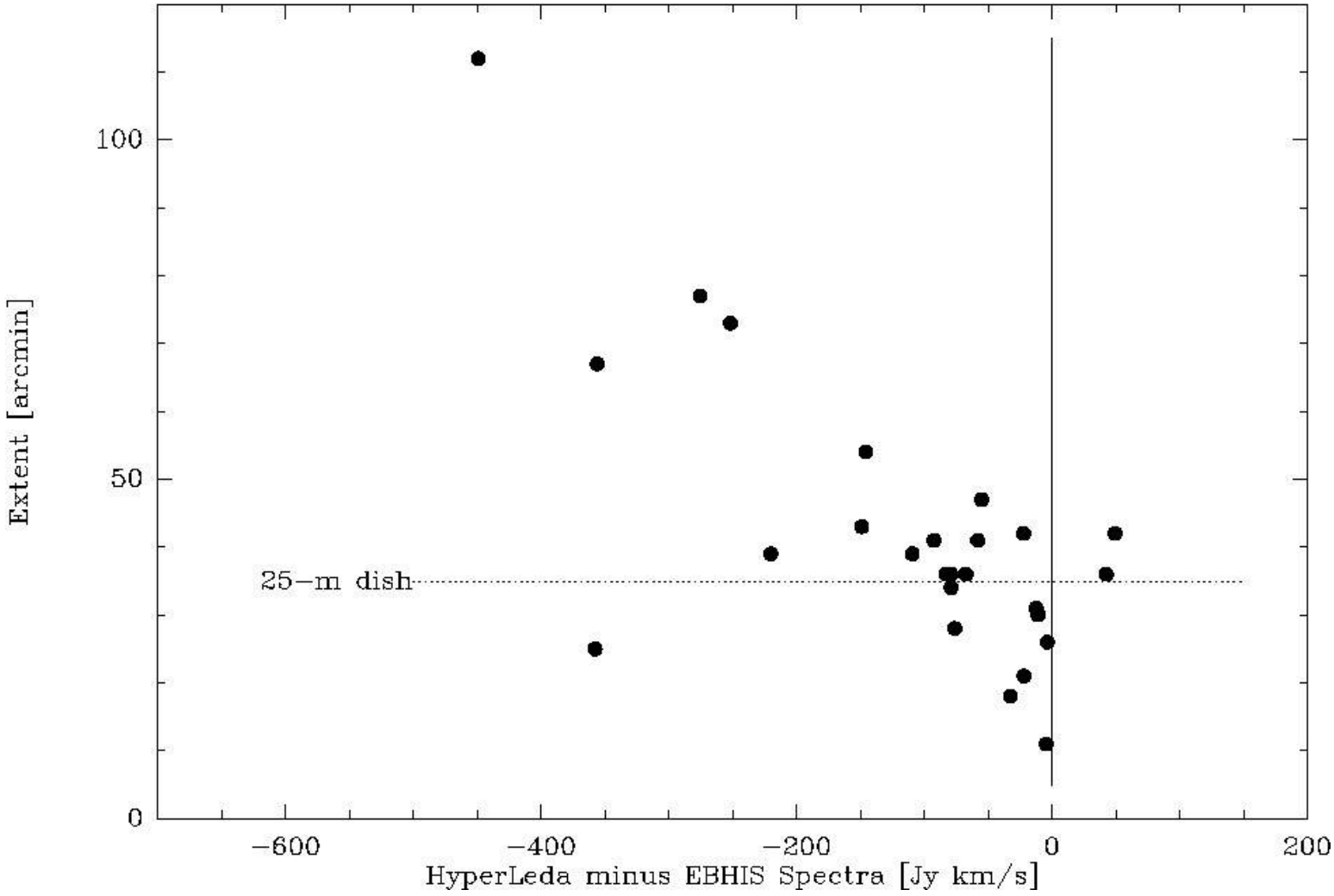
EBHIS vs. HyperLeda: flux comparison II



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EBHIS: Milky Way science prospects

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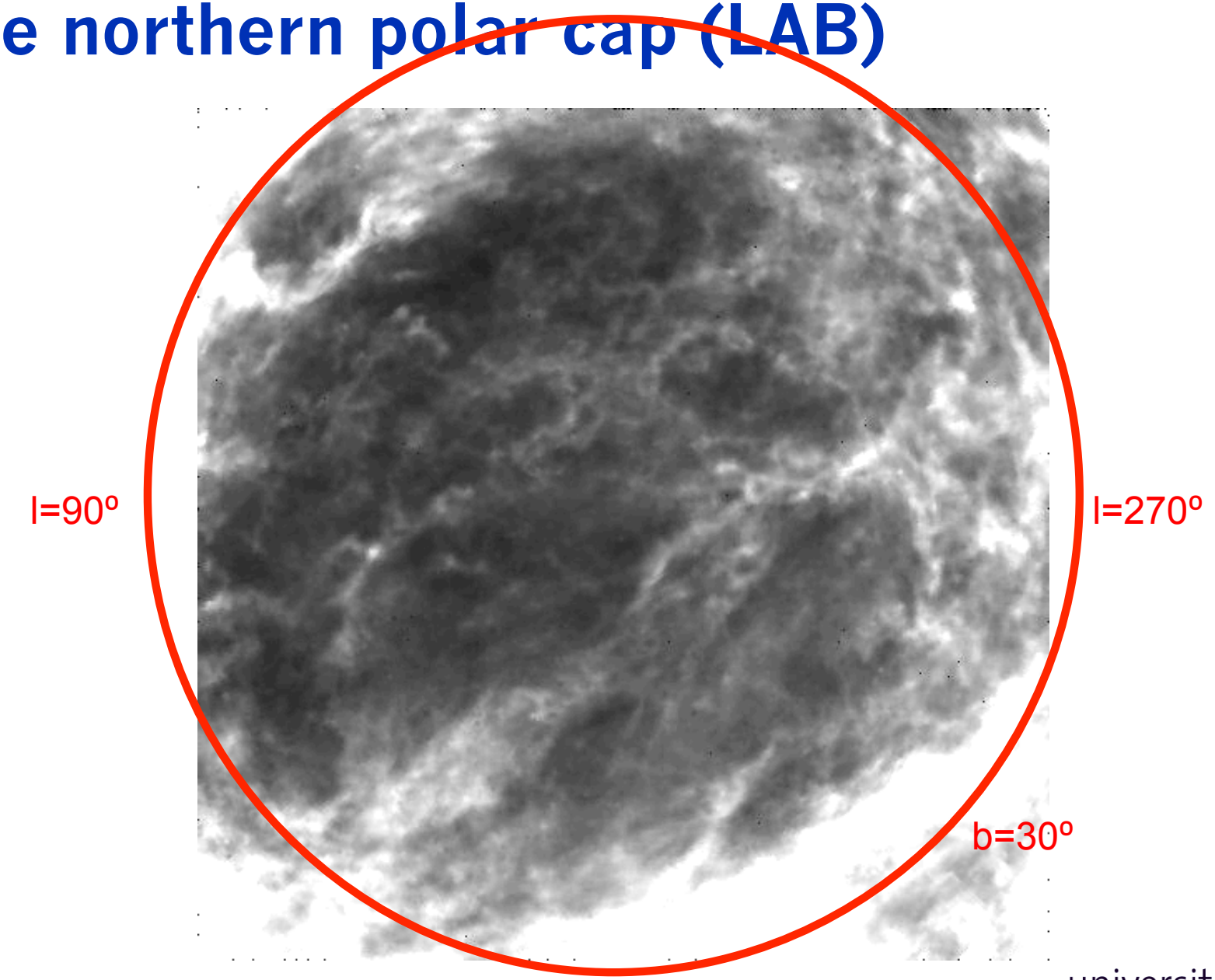
The northern polar cap (LAB)



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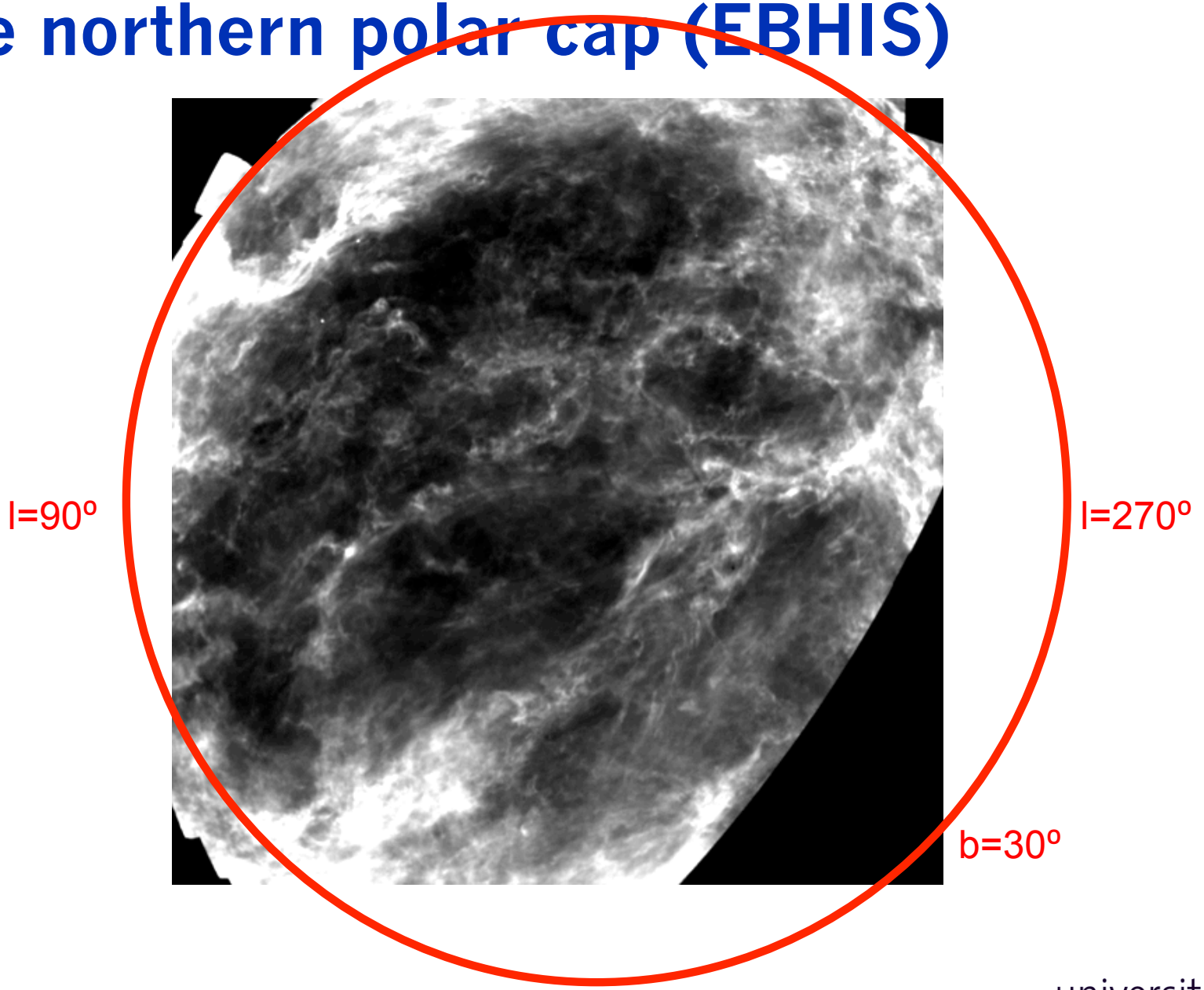
The northern polar cap (EBHIS)



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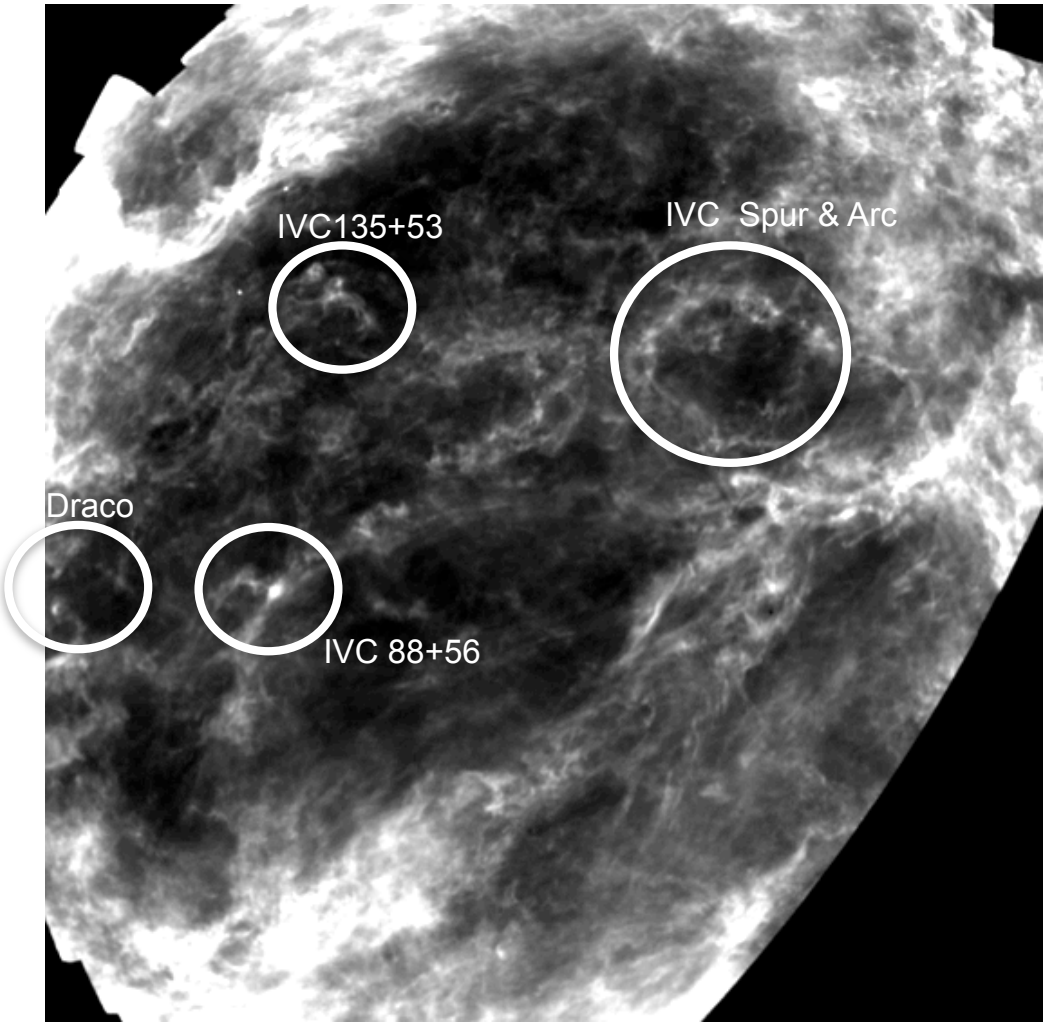
The northern polar cap (EBHIS)



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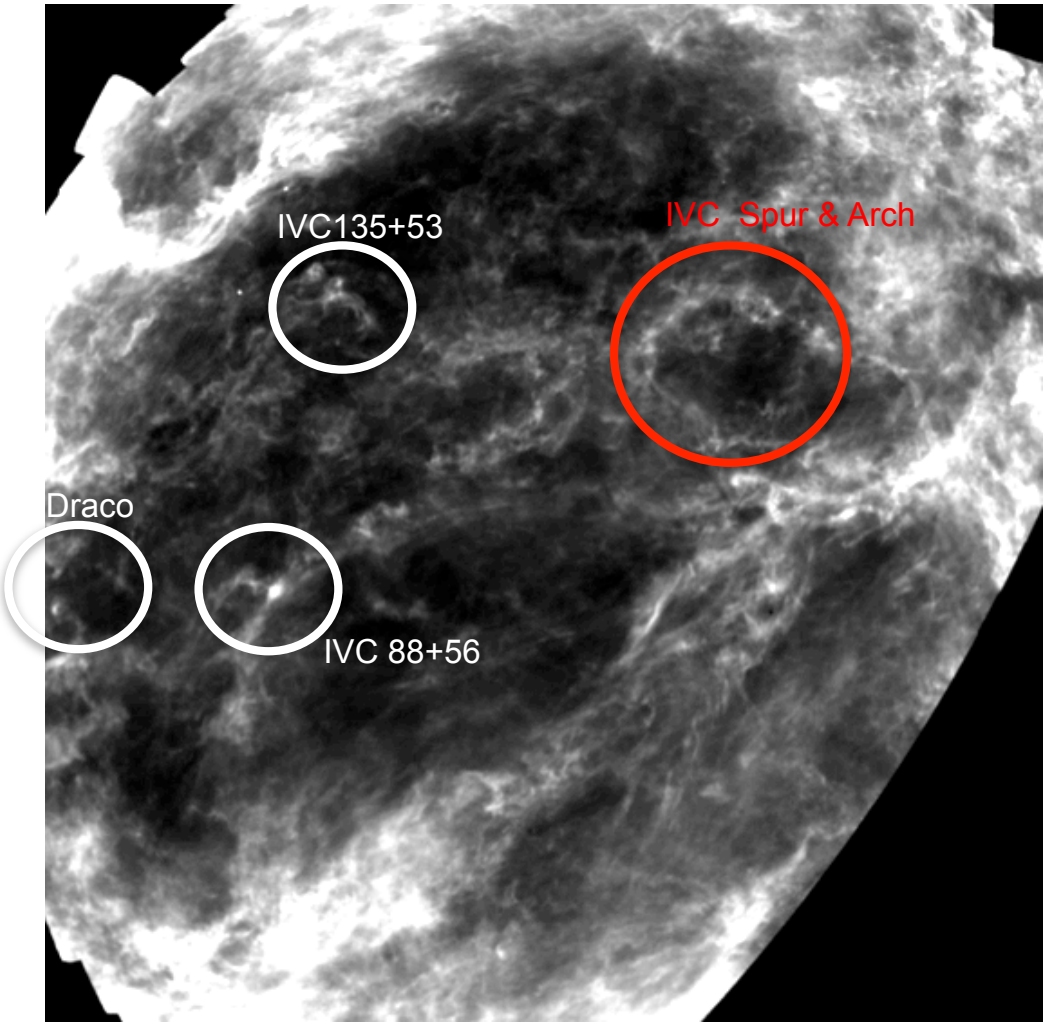
The northern polar cap (EBHIS)



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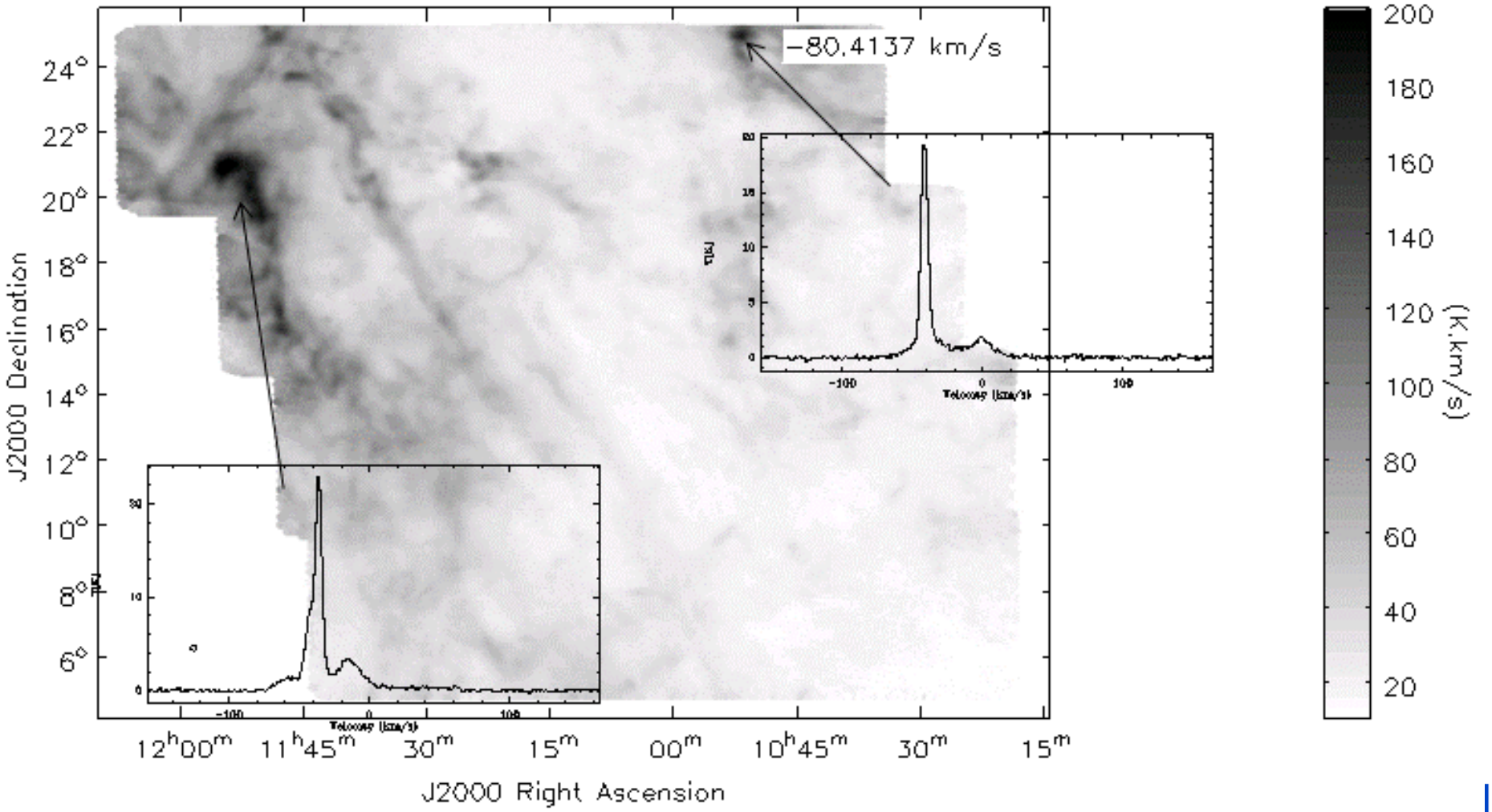
EBHIS-Planck correlation



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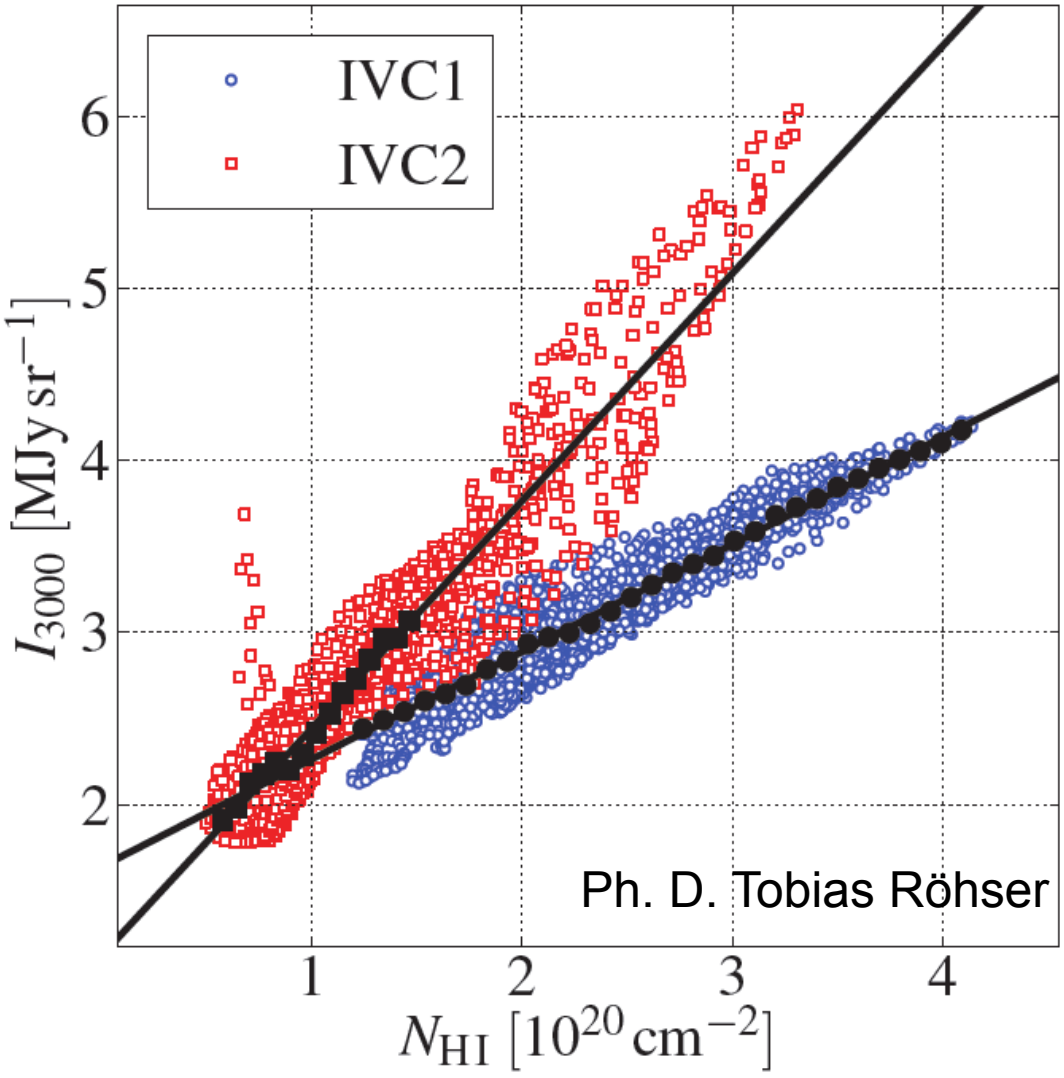
EBHIS-Planck correlation (H_2 formation)



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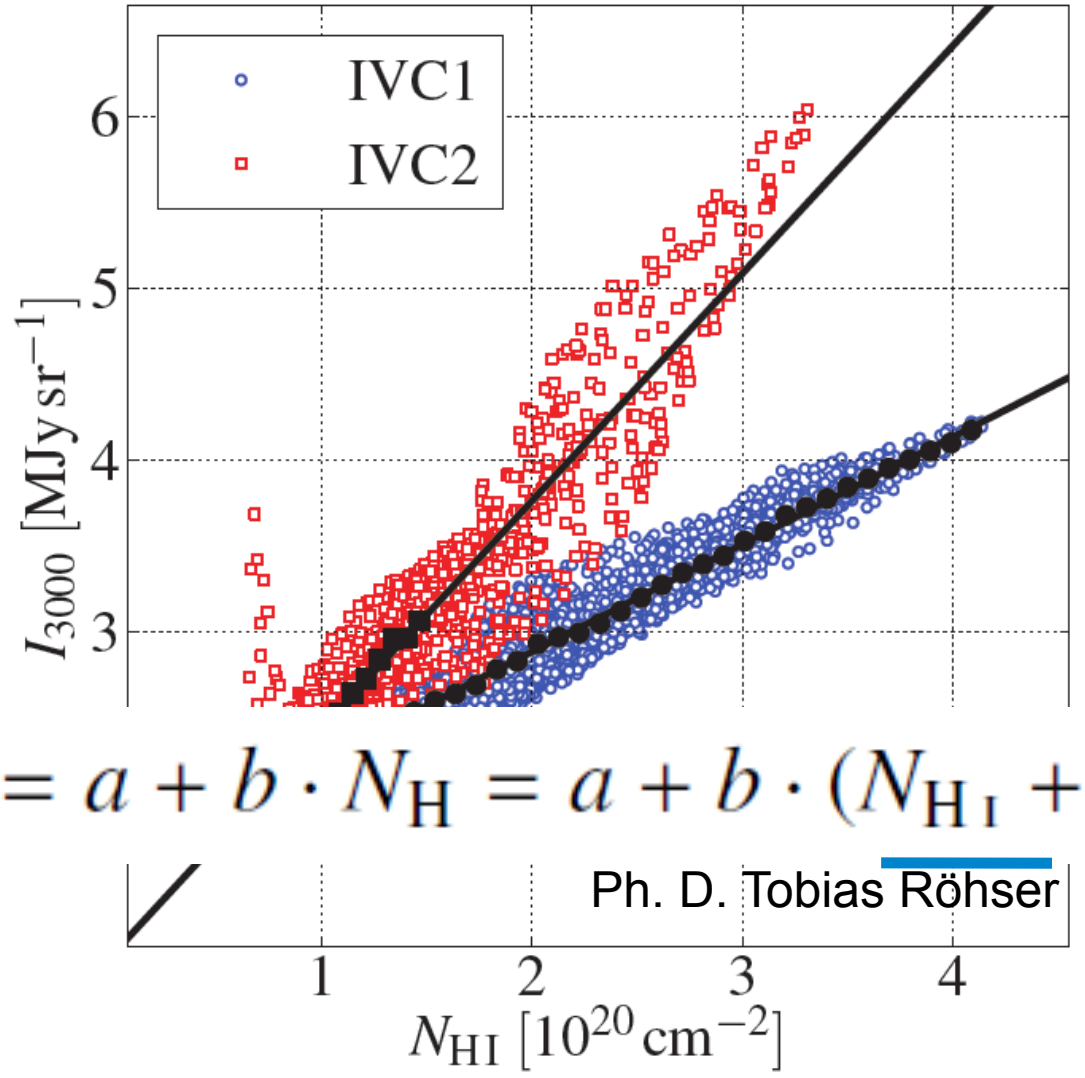

$$I_\nu = a + b \cdot N_{\rm H} = a + b \cdot (N_{\rm H\,I} + 2N_{\rm H_2})$$

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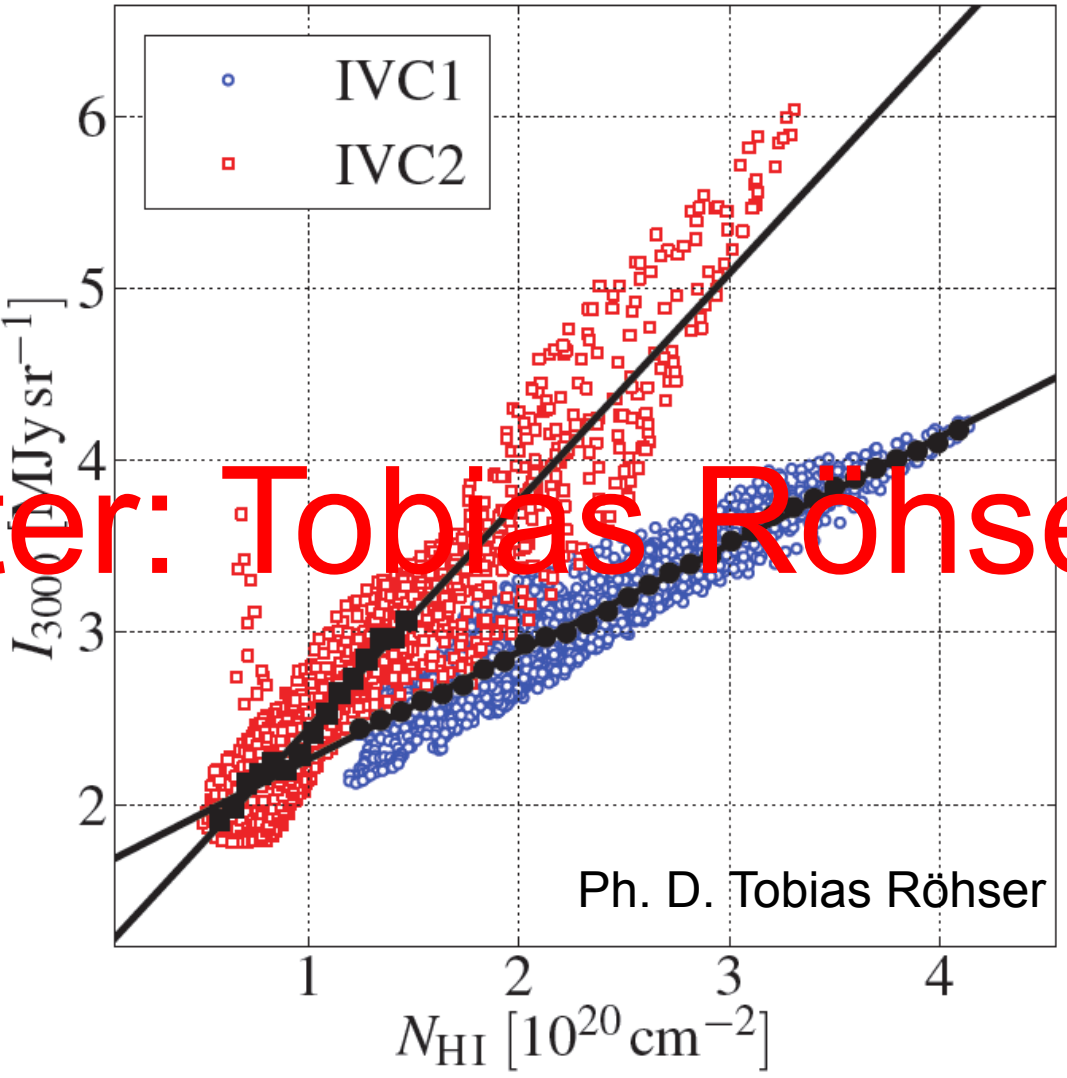
EBHIS-Planck correlation (H_2 formation)



Poster: Tobias Röhser

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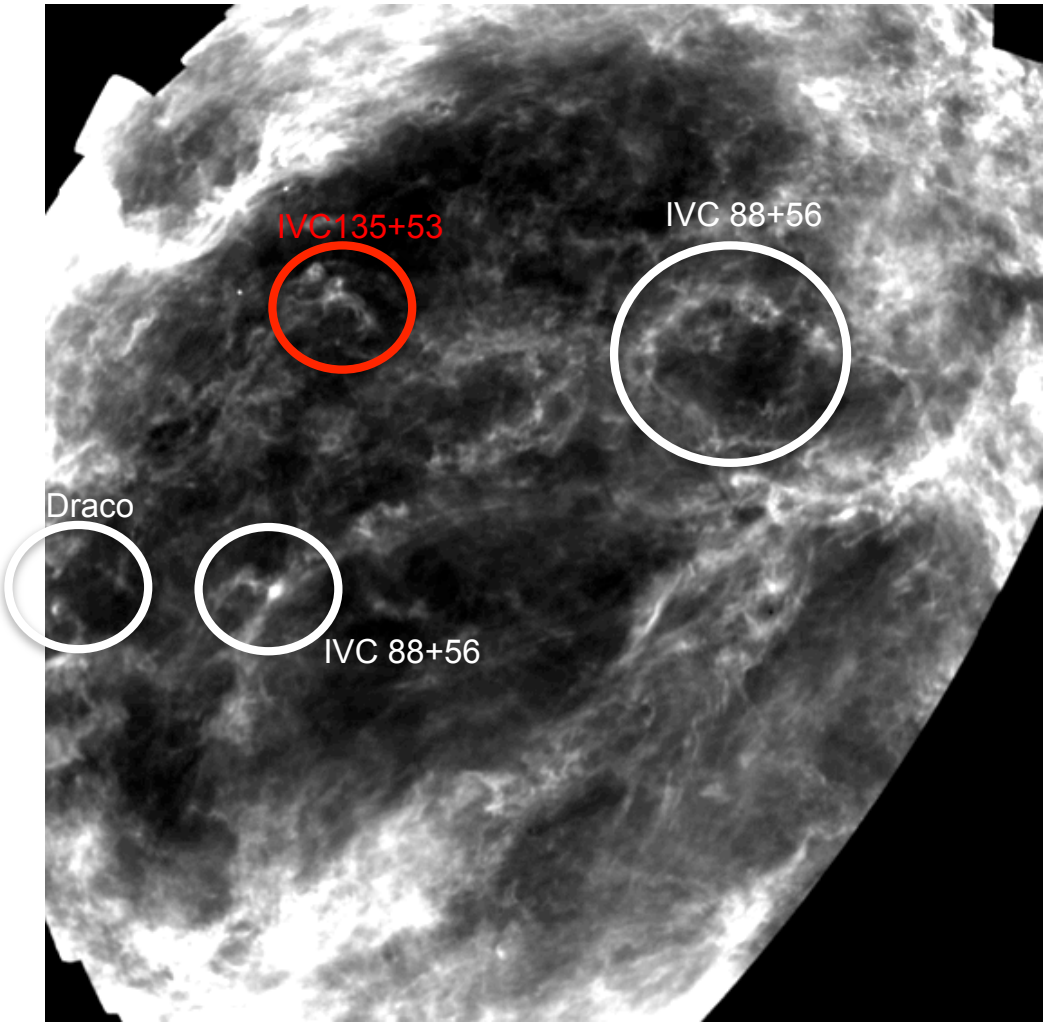
The northern polar cap (EBHIS)



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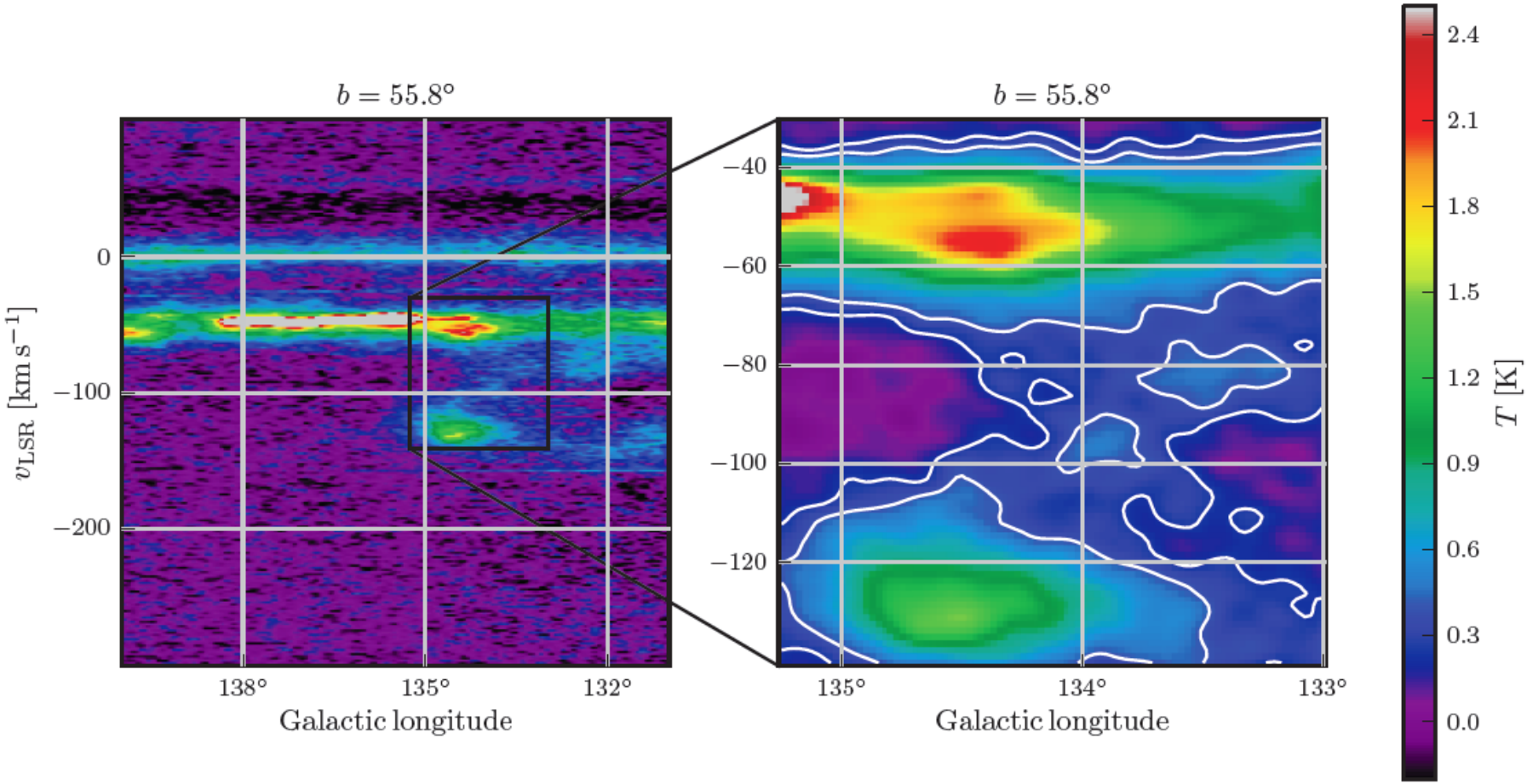
IVC 135+53 (velocity bridge)



Lenz et al., in prep.

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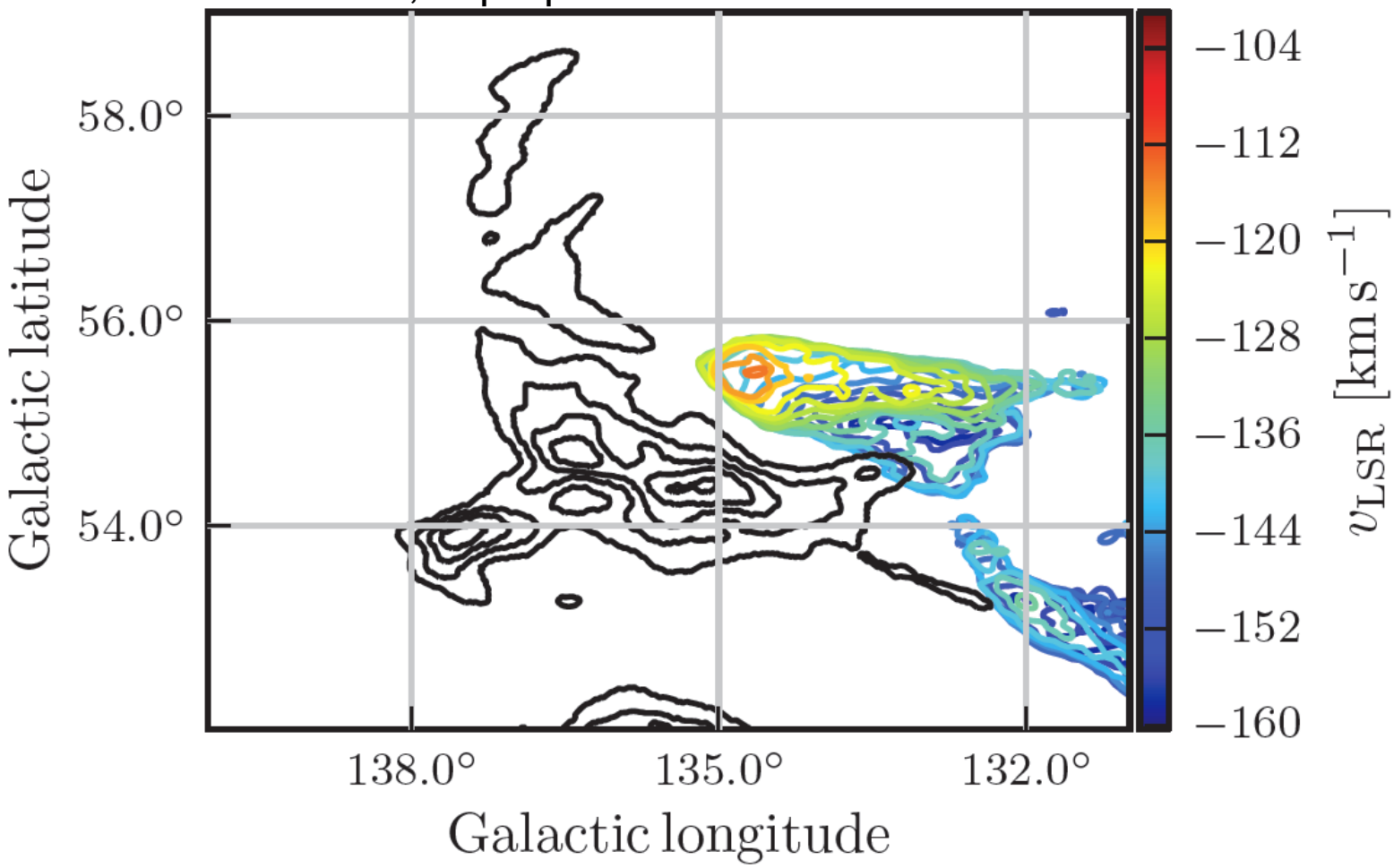
IVC 135+53 (HVC deceleration)

Lenz et al., in prep.



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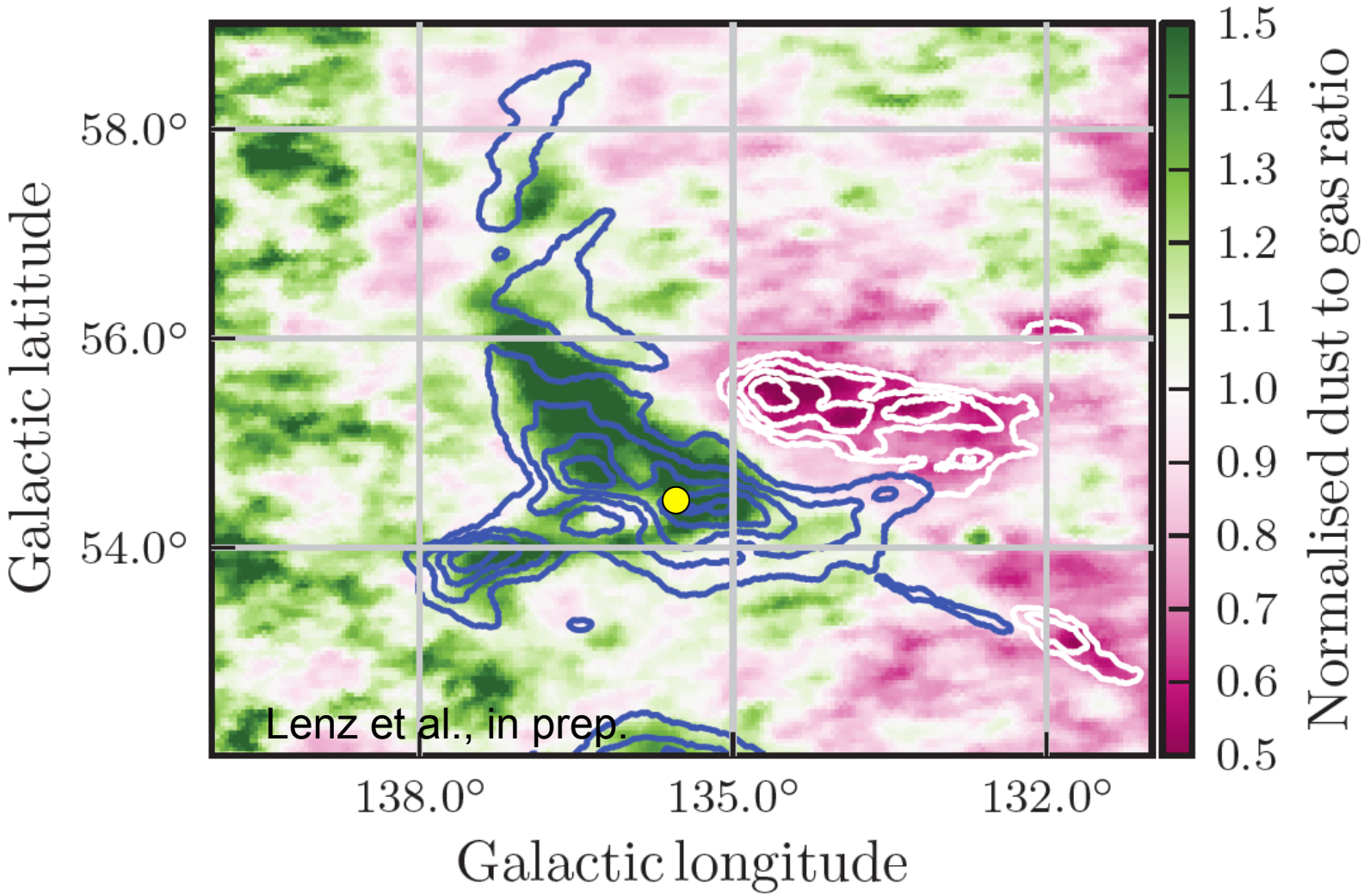
IVC 135+53 (dust-to-gas ratio)

-0.43±0.12 dex (Feige 48) Hernandez et al. 2013, submitted



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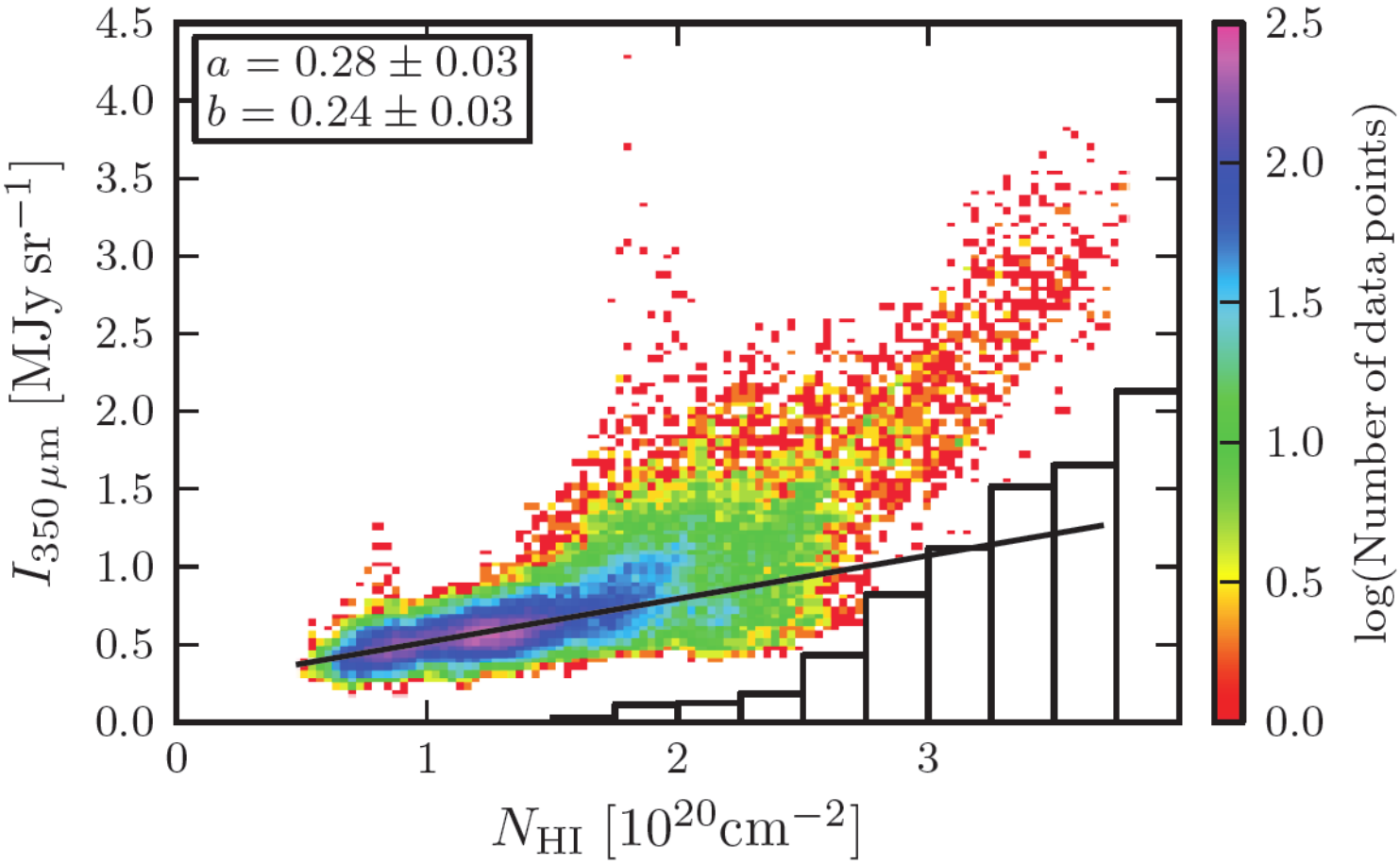
IVC 135+53 (EBHIS-Planck → H_2 map)



Lenz et al., in prep.

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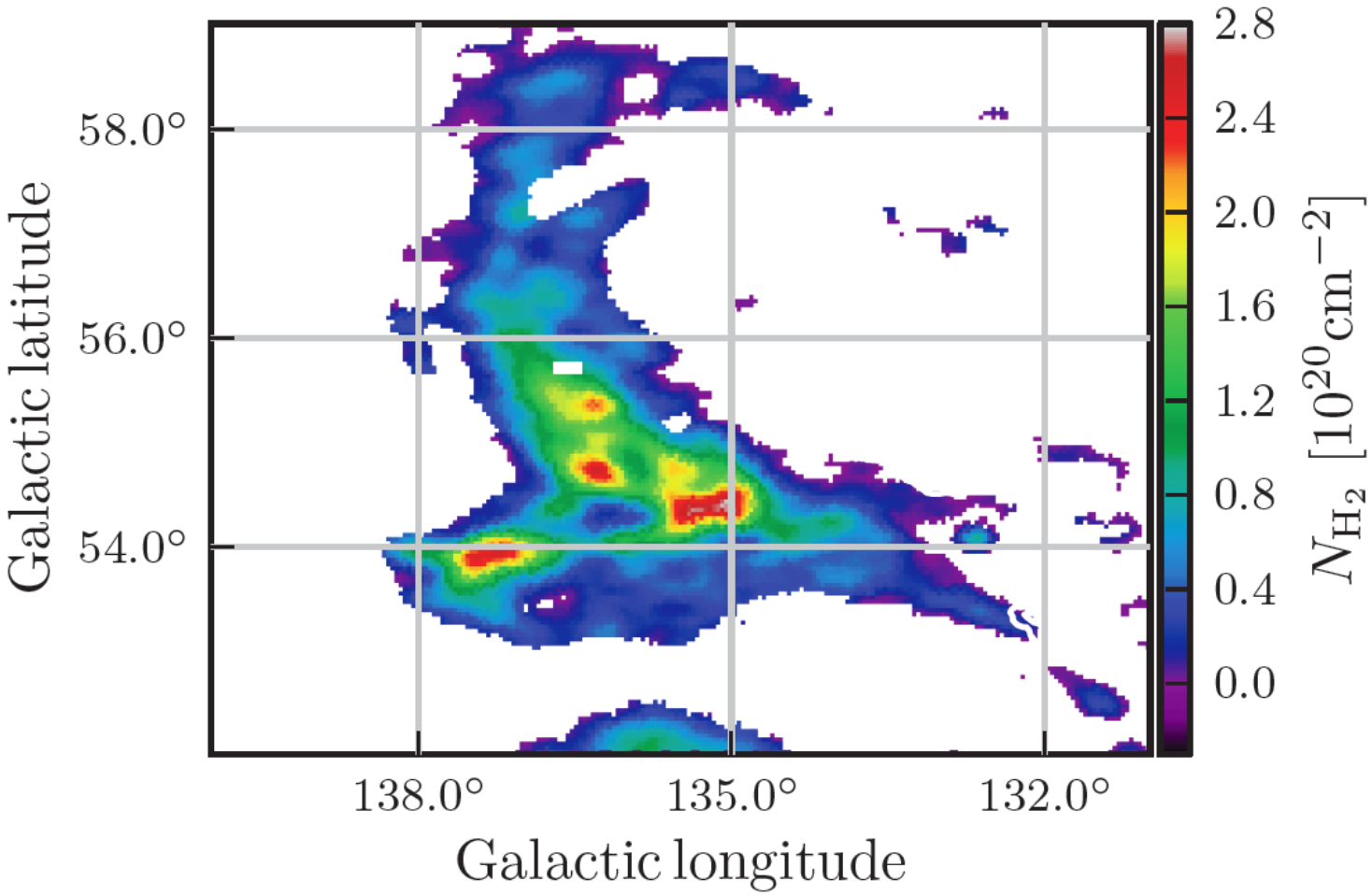
IVC 135+53 (EBHIS-Planck → H_2 map)



Lenz et al., in prep.

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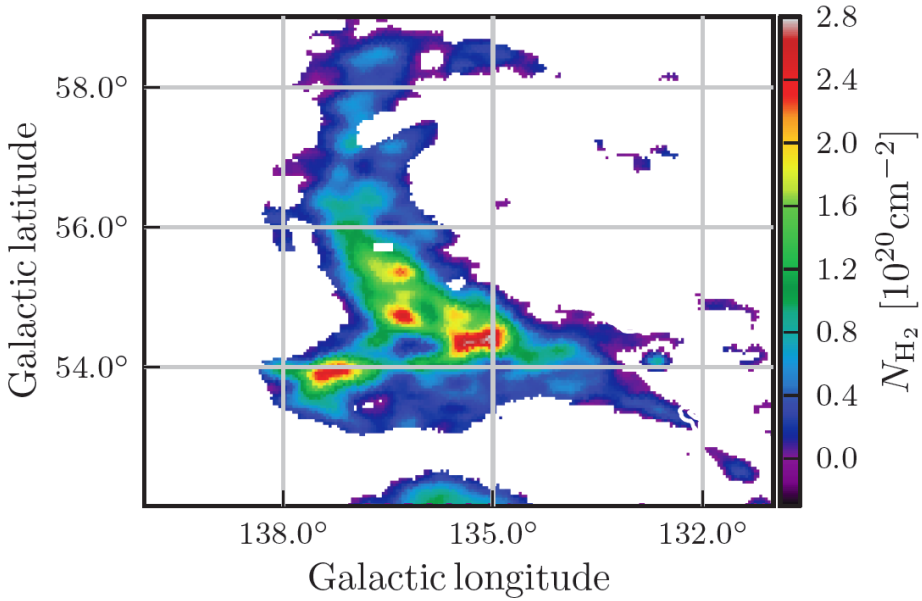
H_2 rain? (HVC triggered IVC H_2 formation?)

1. Towards the northern polar cap we observe about $1 \cdot 10^6$ M_{sun} @ 500 pc altitude
2. Say 10% of the mass H_2
3. Northern polar cap 1sr
4. Yielding $1 \cdot 10^6$ M_{Sun} of H_2 full sky
5. Free fall time t ~ 10^6

1 M_{sun}/year (low metallicity)



Extent 5 pc distance about 500 pc

→ 35' @ 500 pc

→ 21" @ 50 kpc (LMC/SMC)

→ 0.3" @ 3.5 Mpc (Ursa Major)

"Dark Gas" Wolfire, Hollenbach & McKee 2010, ApJ 716, 1191

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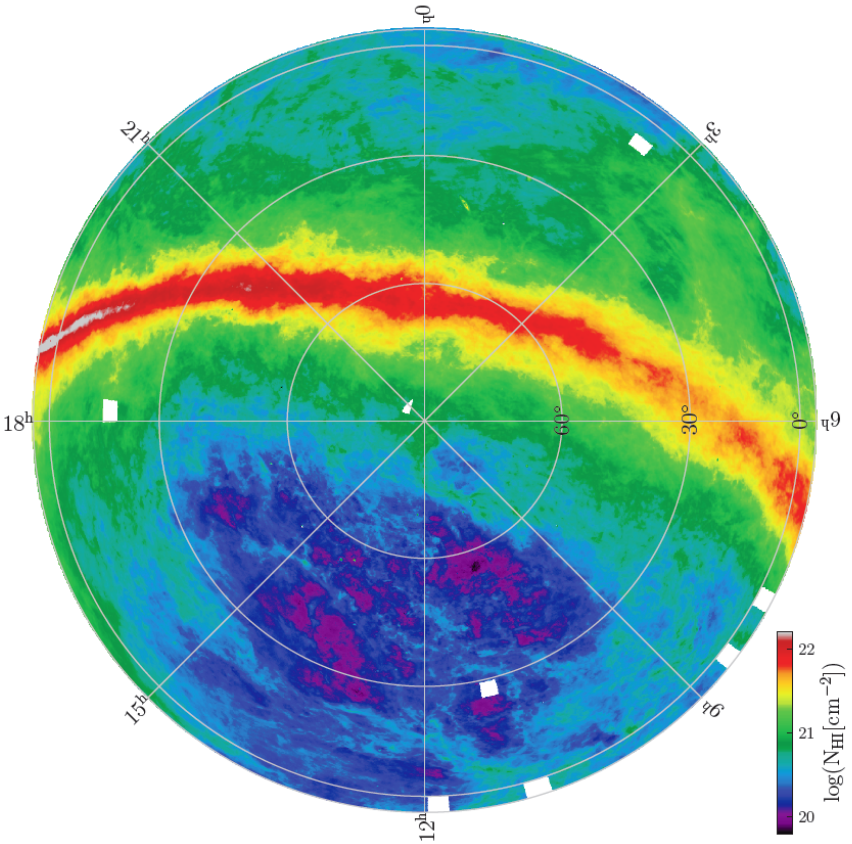
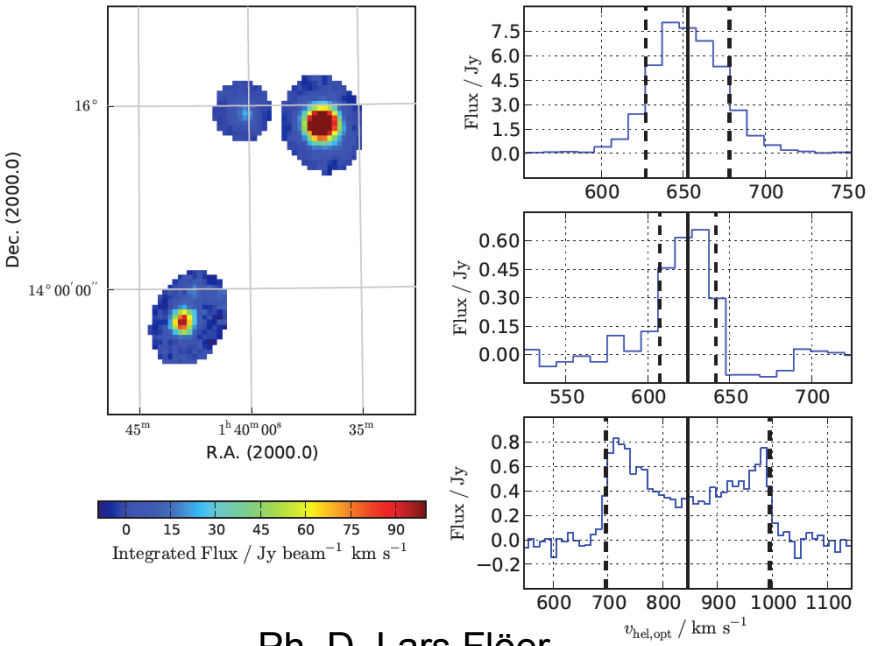
EBHIS products





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The future: second coverage > 30º

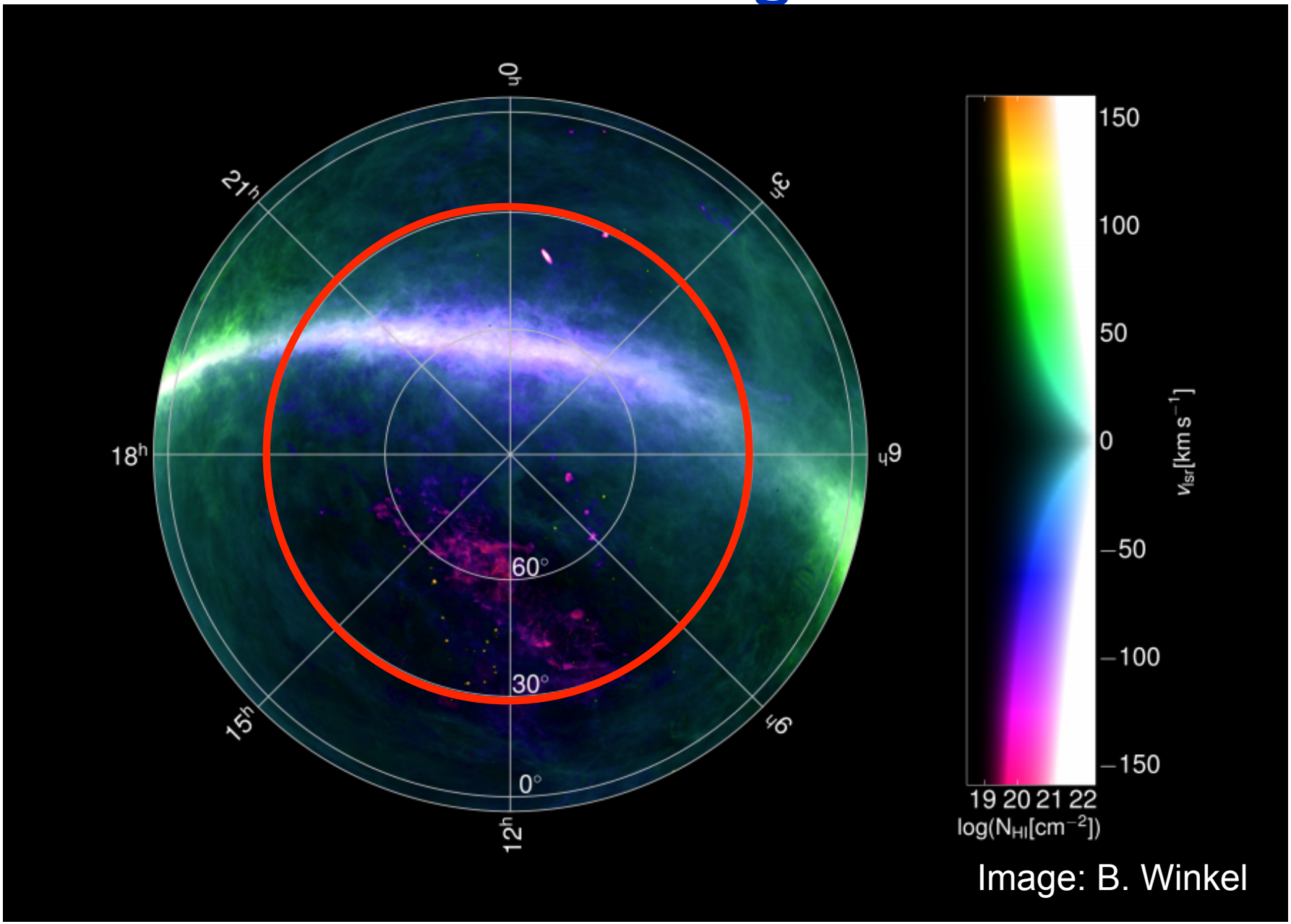

Image: B. Winkel

Thank you!

KE757/7-1 to 7-3

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