# *Tearing the Veil: EVLA Observations of the HI Environment of the Orion Nebula*

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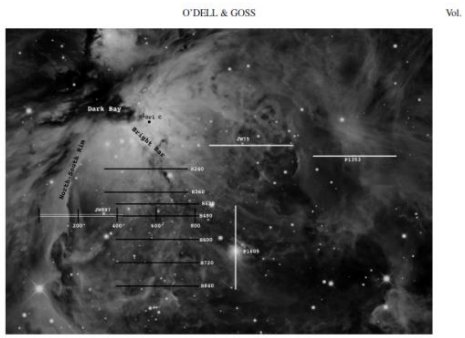
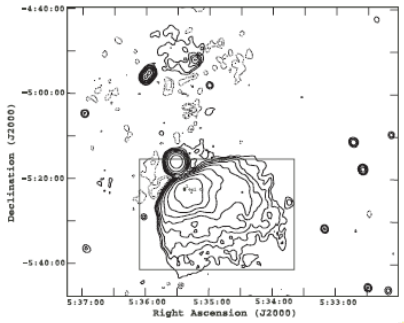
28th Annual NM Symposium

30 Nov. 2012

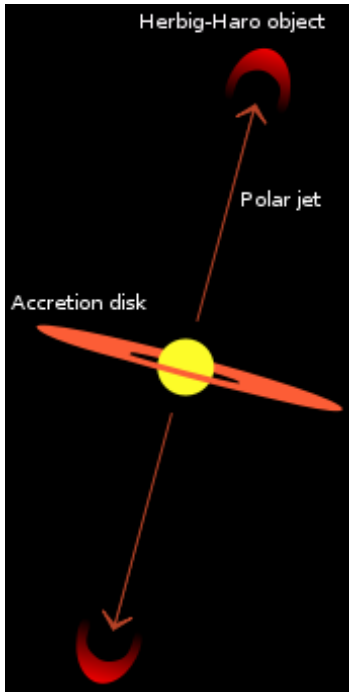
Socorro, NM

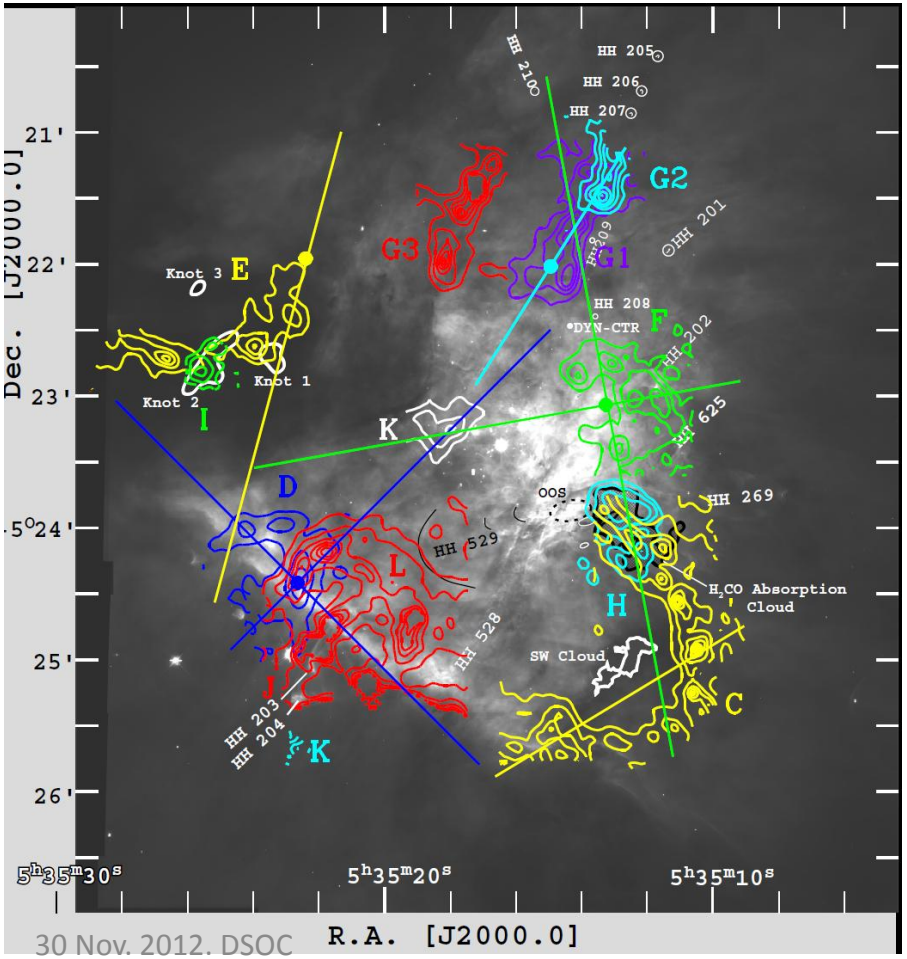


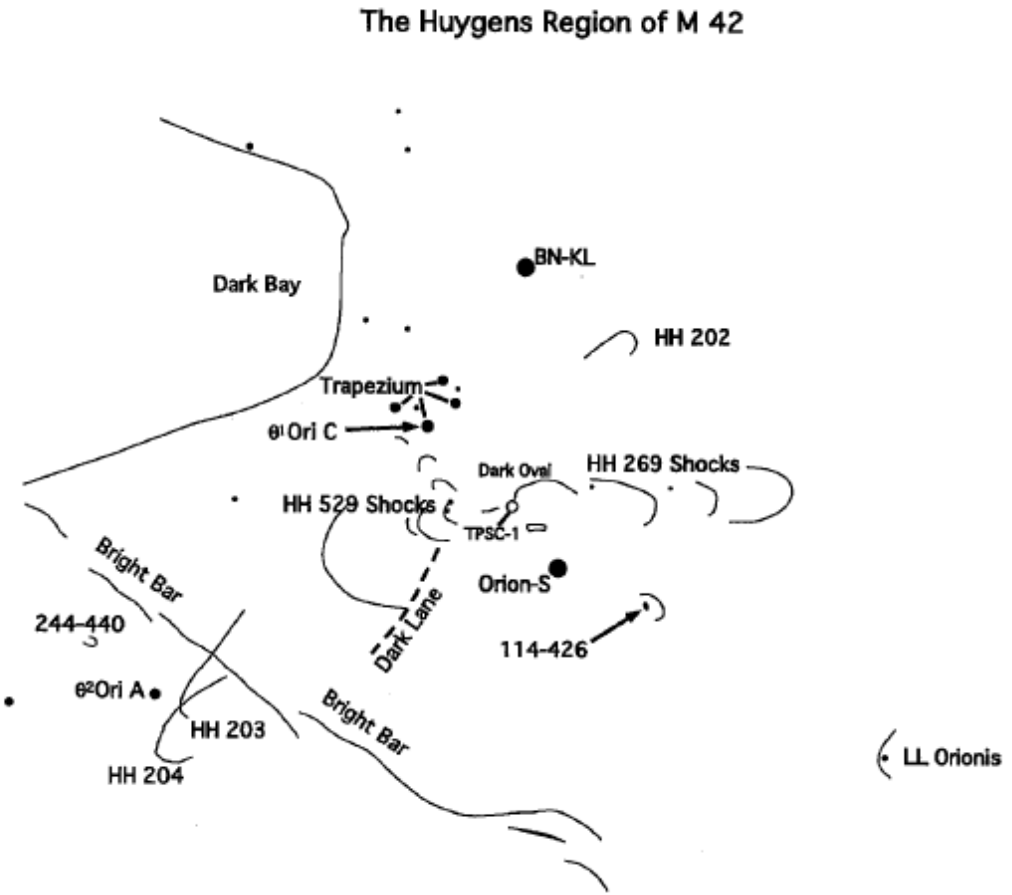
Why study Orion? The Orion Nebula has become a cornerstone of understanding massive star formation- and the Orion Molecular Cloud-

Herbig –Haro objects are nebulae associated with newly born stars and formed when narrow jets of gas ejected by the star collides with nearby clouds of gas and dust at velocities of several hundred km/s.

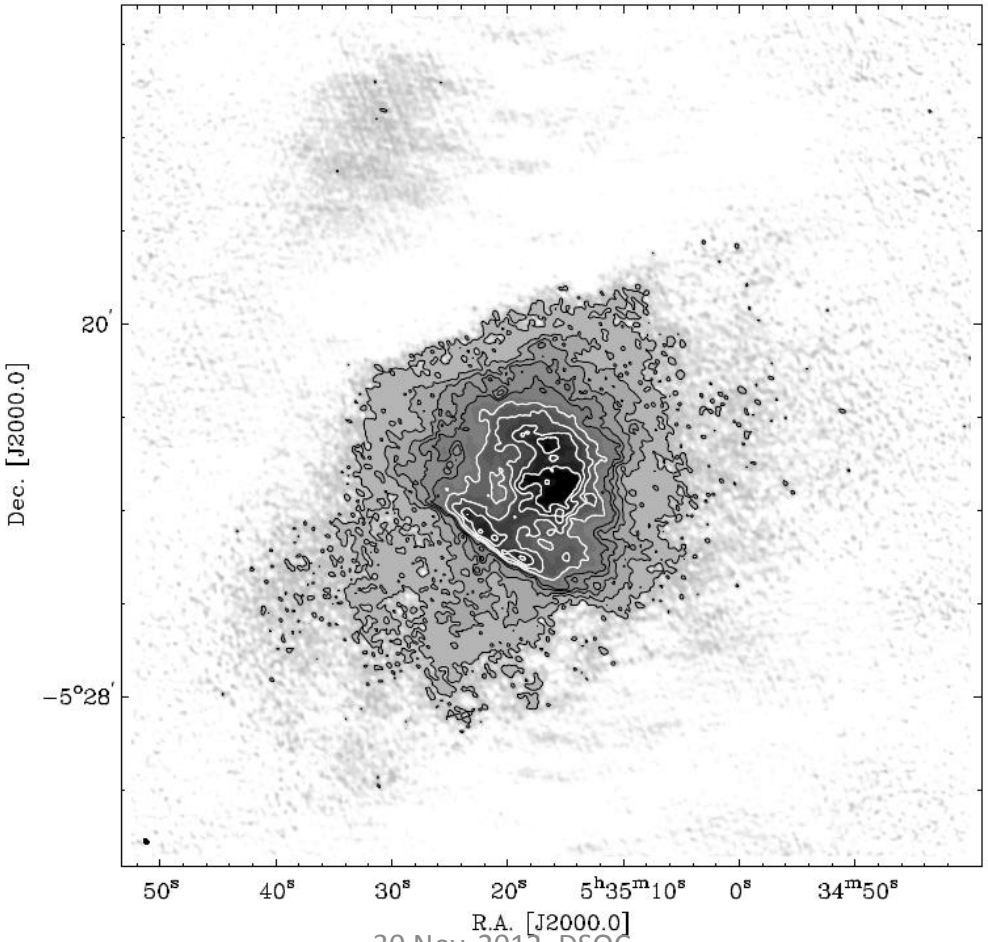


# ON the SKY


The Huygens Region of M 42
Dark Bay
BN-KL
HH 202
Trapezium
θ¹Ori C
Dark Oval
HH 269 Shocks
HH 529 Shocks
TPSC-1
Bright Bar
Orion-S
244-440
Dark Lane
114-426
θ²Ori A
HH 203
Bright Bar
HH 204
LL Orionis

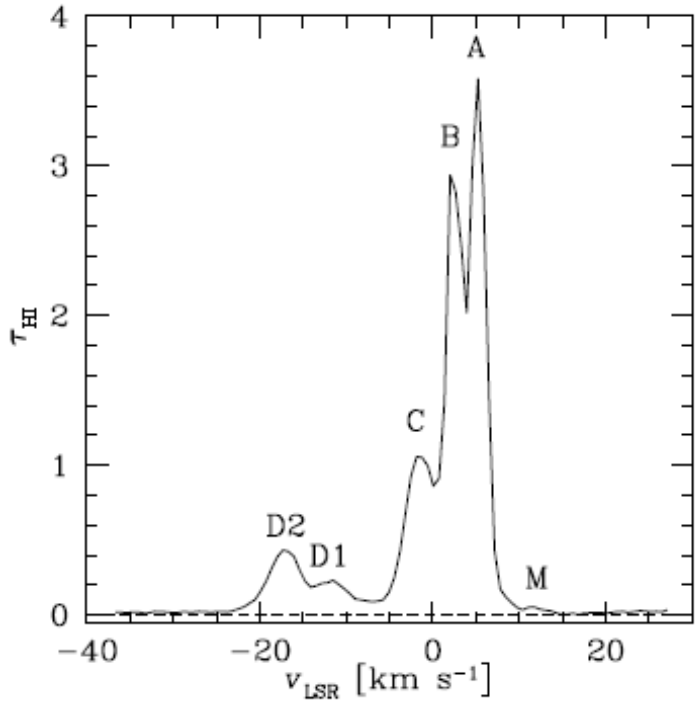
# New EVLA data B and C array 2006-20077-- 6 arc sec (2800AU or 0.014 pc) and velocity resolution 0.8 km/s- 120 km/s velocity range instead of 40 km/s



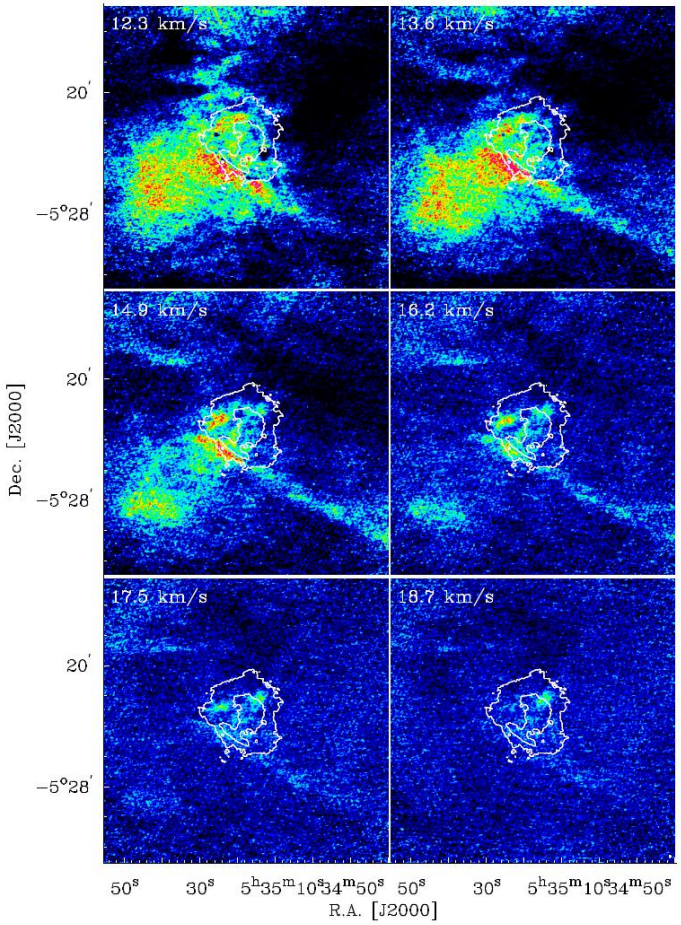
# What is New ?

- 5 new small 'high velocity regions'- component F associated with HH202- sizes in range < 0.014 pc, and then 0.05 to 0.2 pc, masses .001 to 0.07 $M_{sun,}$ densities 1000 to 10,000 $cm^{-3}$
- HI emission- gas behind the HII- PDR, especially in the Orion Bar. Only velocities outside -20 to +10 km/s. NOTE OMC vel is close to +10 km/s
- HI emission peaks where $H_2$ peaks. $T_k$ is 500 K and HI to $H_2$ in interclump gas is 5-10 per cent
- HI in the Kleinman-Low region

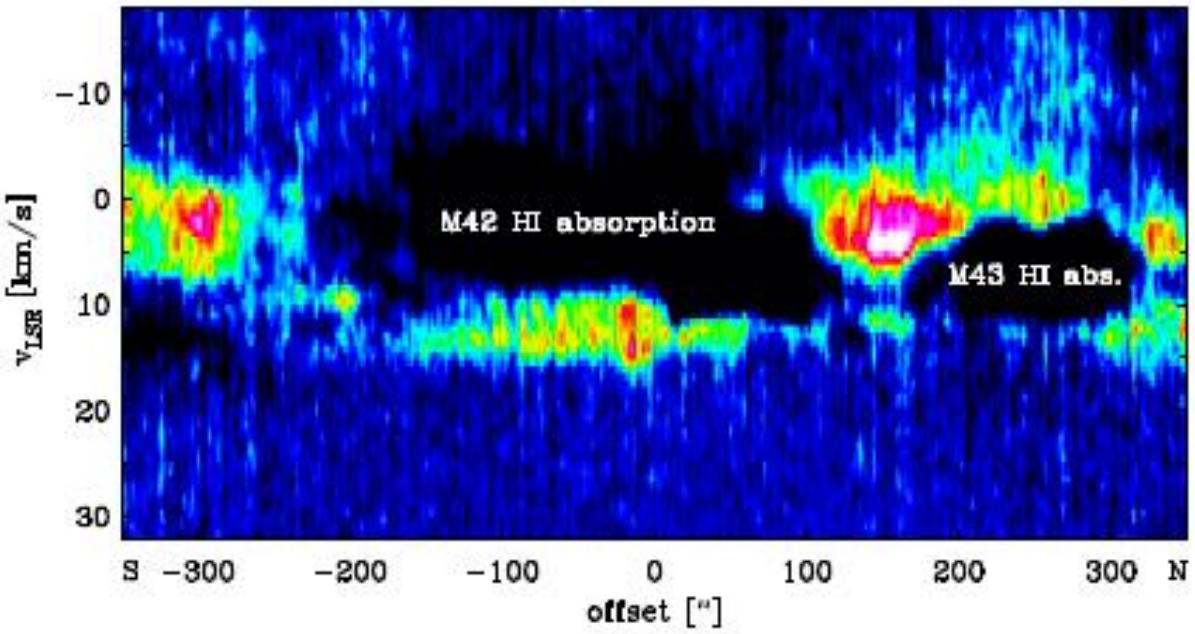
# Typical HI absorption profile- A &B are HI in the envelope of OMC-1



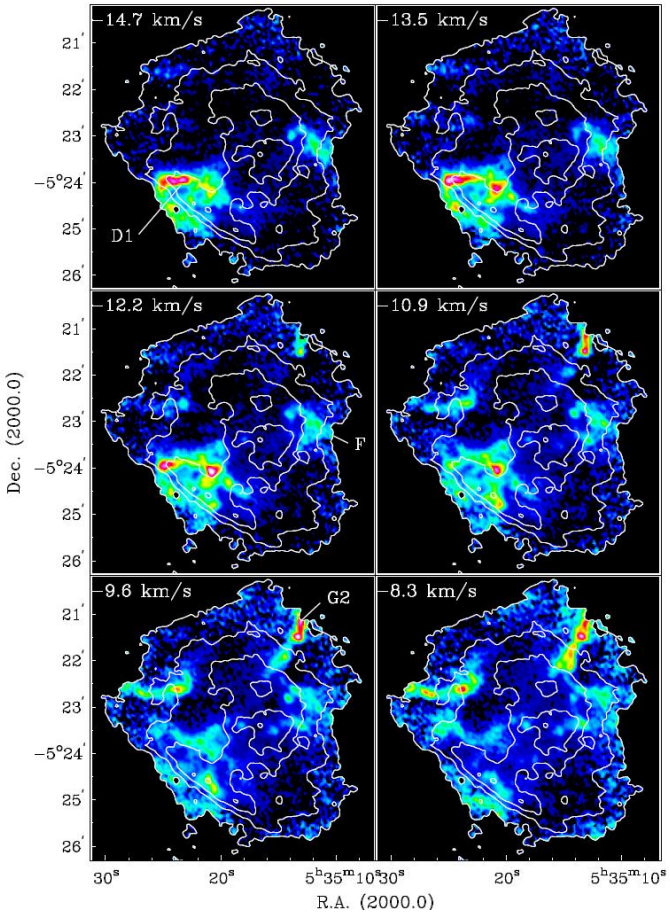
# HI Emission – $T_b$ 150 to 400 K-noise 20K



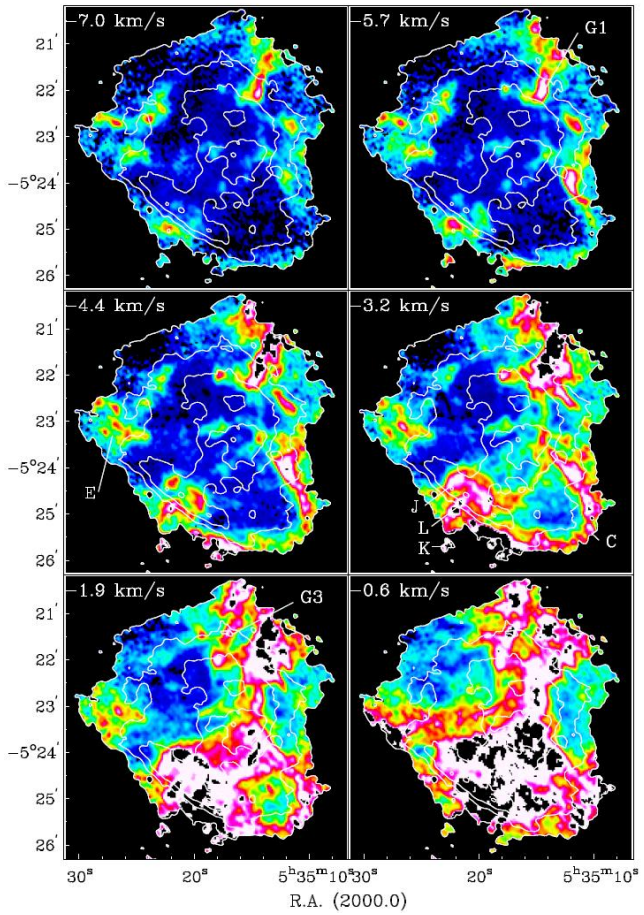
# HI emission PV diagrams

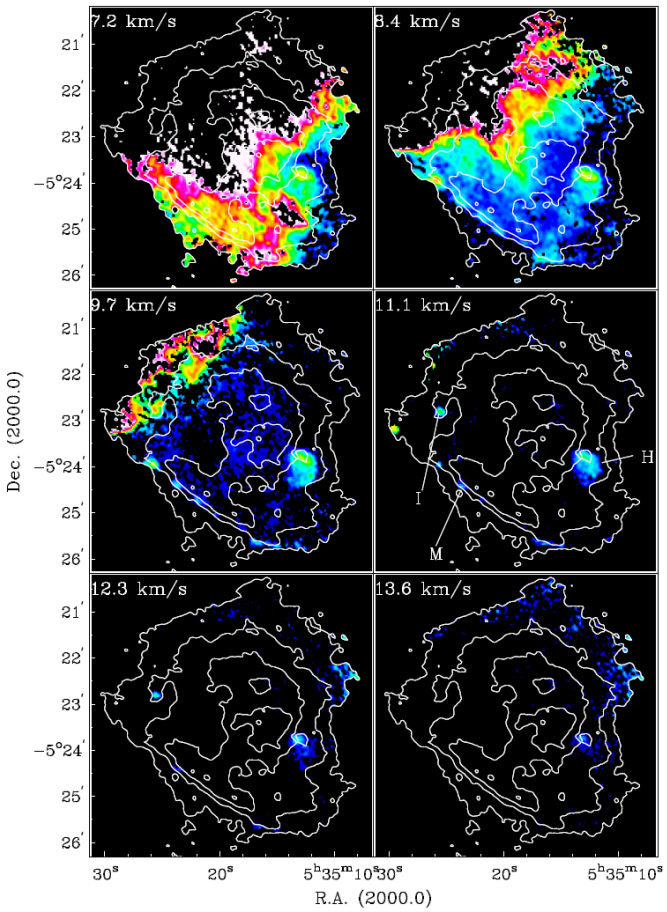


# Some opacity profiles

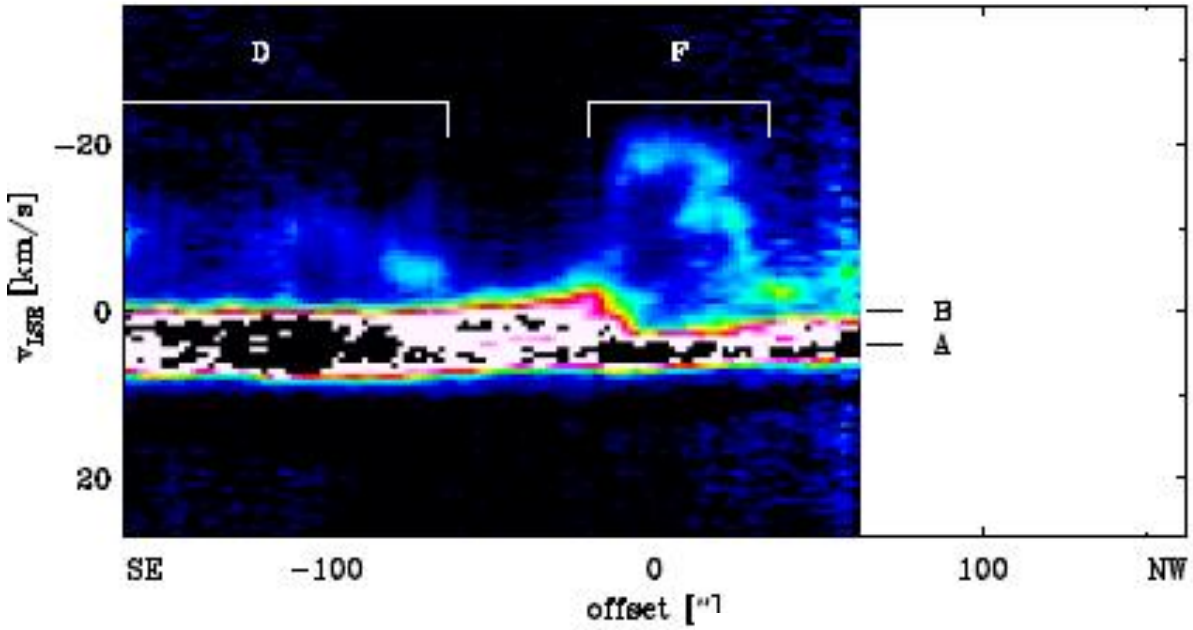


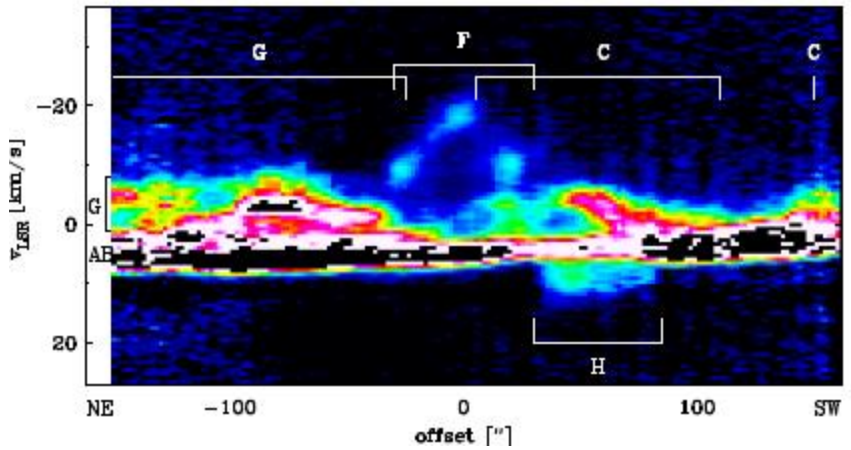
# Note saturated areas- in black



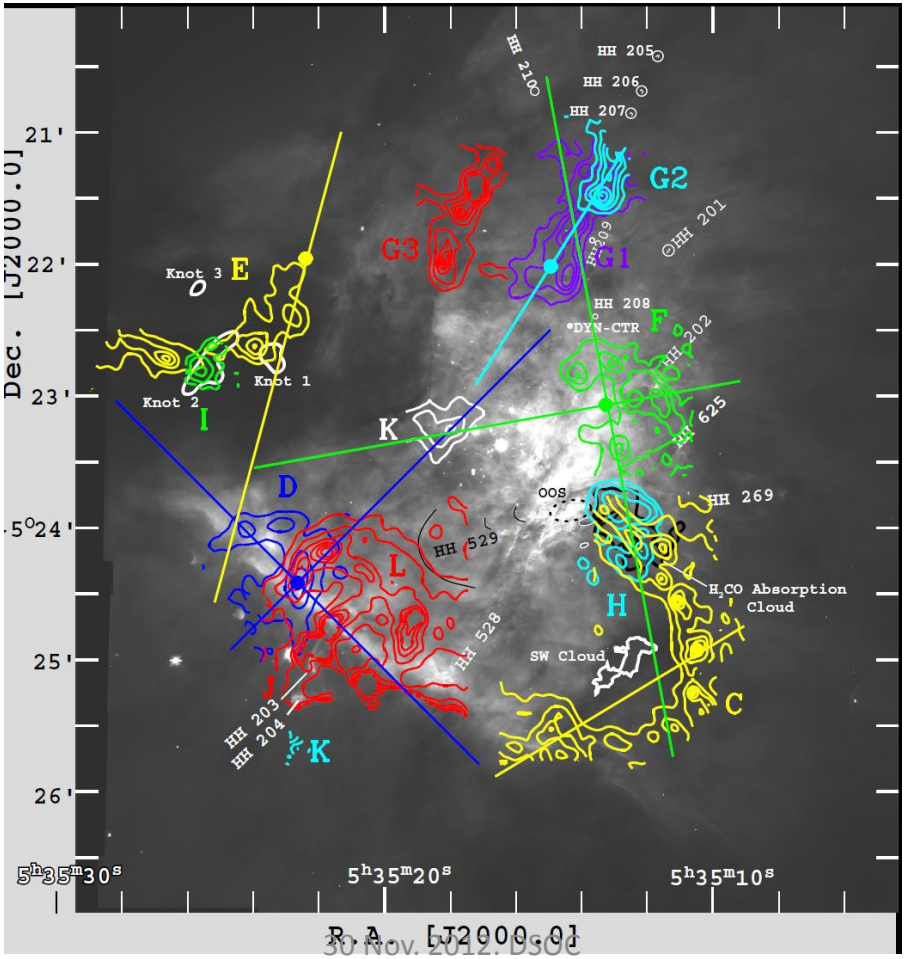

7.2 km/s
8.4 km/s
9.7 km/s
11.1 km/s
12.3 km/s
13.6 km/s
H
I
M
Dec. (2000.0)
R.A. (2000.0)
21′
22′
23′
−5°24′
25′
26′
30ˢ
20ˢ
5ʰ35ᵐ10ˢ

# Comp. F associated with HH 202



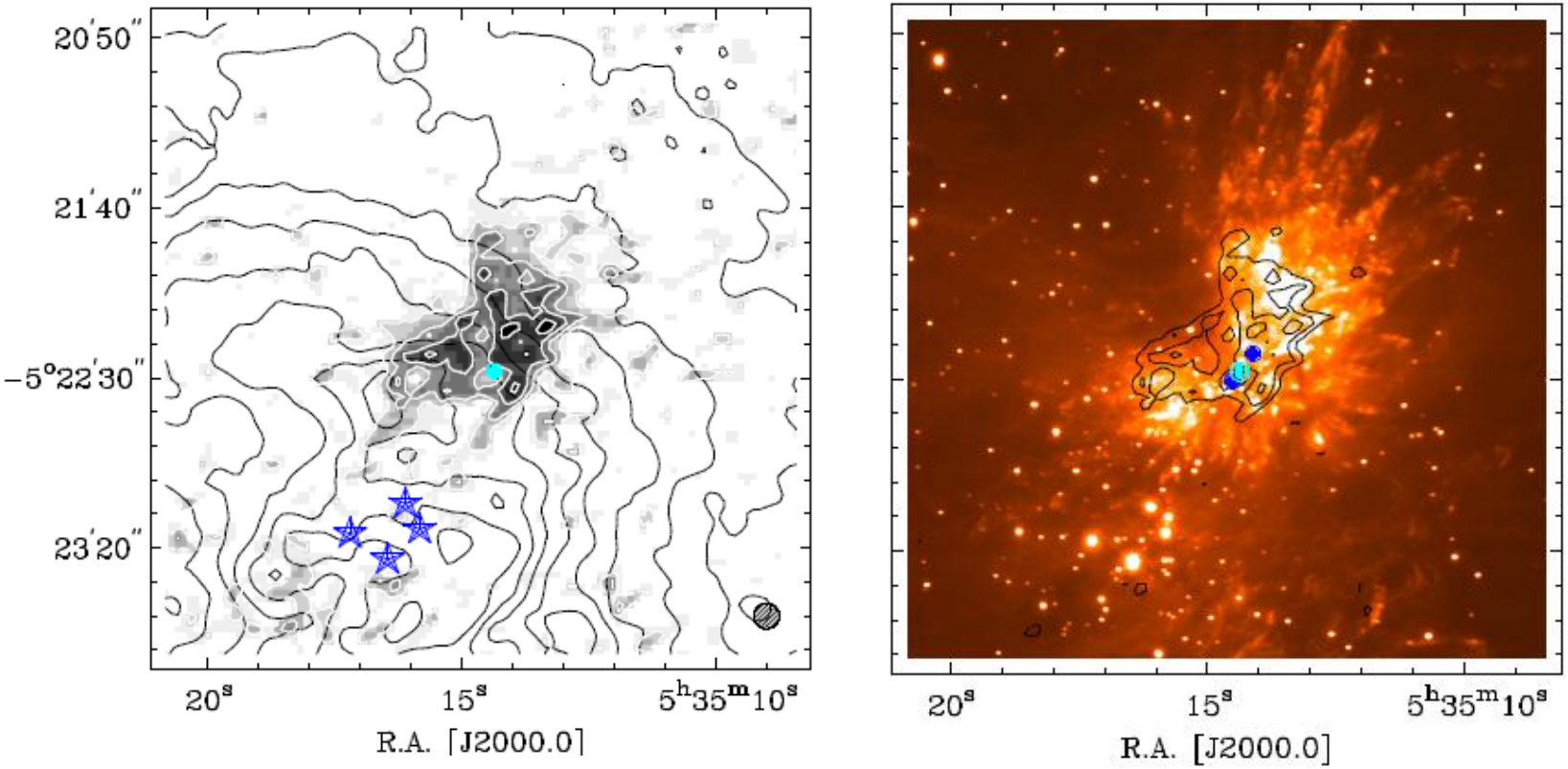
# Note HI component F and HH 202 to the West



# HI Source F associated with HH202

- ‘Component F clearly plays a crucial role in analysis of the interaction of the ionized flows with the Veil.’ The component is driven by HH 202. Flow originates in OOS (optical outflow source)
- Conclude that component F and the Veil lie only 0.3 pc in from of Orion S , comparable to the Trapezium . Thus the Veil is at most 0.4 pc in front of the Trapezium
- In summary HH202 and the HI component F are formed by a jet creating a bow shock in both the ionized gas (observed as HH 202) and the neutral Veil (observed as HI component F) . Part of the Veil gas is accelerated to a more negative velocity by the impact of the jet

# Klein-Low region in HI emission-size 0.1 pc. Mass in HI is $10^{-4}$ $M_0$ or 0.1 Jupiter- and Mass in molecules 5 $M_0$



# Summary

- Sensitive and high dynamic range observations in HI lead to
- Information about the geometry and dynamics of the Orion Nebula – radiative and mechanical feedback
- Information about the Veil and molecular components of the Orion Nebula
- Most surprising is the HI emission from HOT HI in PDR's in the Orion Nebula

# Summary – HI morphology

- Large scale features – both M42 and M43 covered by components A and B
- Arc like features eg component D and F and maybe component C
- Elongated features like G and J
- Features at velocity of the background molecular cloud

# Schematic view along the line of sight- observer at left



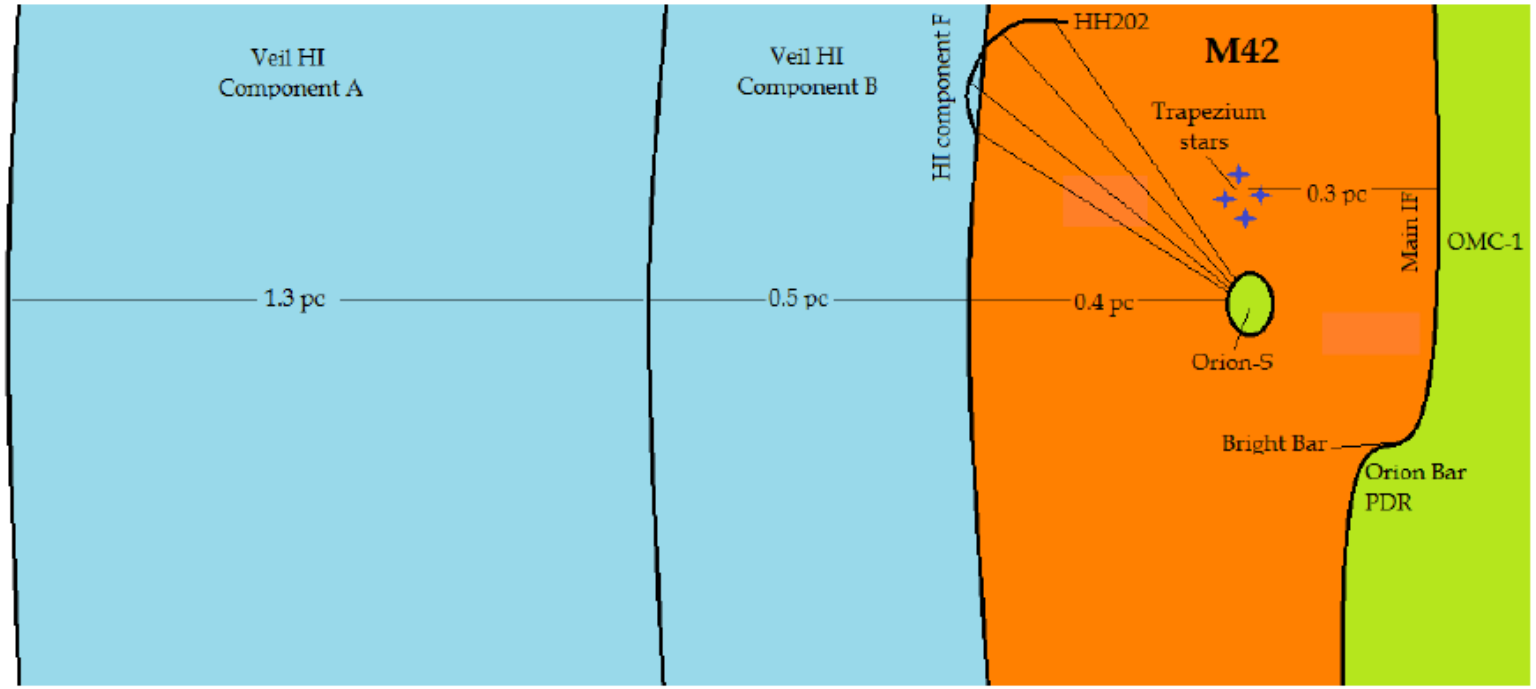



FIG. 22.— Schematic geometry of M42 and the neutral Veil, illustrating the line-of-sight depths (approximately but not exactly to scale) of the various components. Orange indicates ionized gas, green indicates molecular gas and blue indicates atomic gas. The outflow originating in Orion-S, which powers the kinematics of HH 202 and H I component F is schematically indicated by a set of thin lines.