

# Story, Layout and Color

# Tell a story with a message!

**Not in the way you found it  
but in the way your  
audience can find it**

# The story's message

- 3 bullet point rule
- Short sentences & key words
- Use Color to highlight

# Consistency

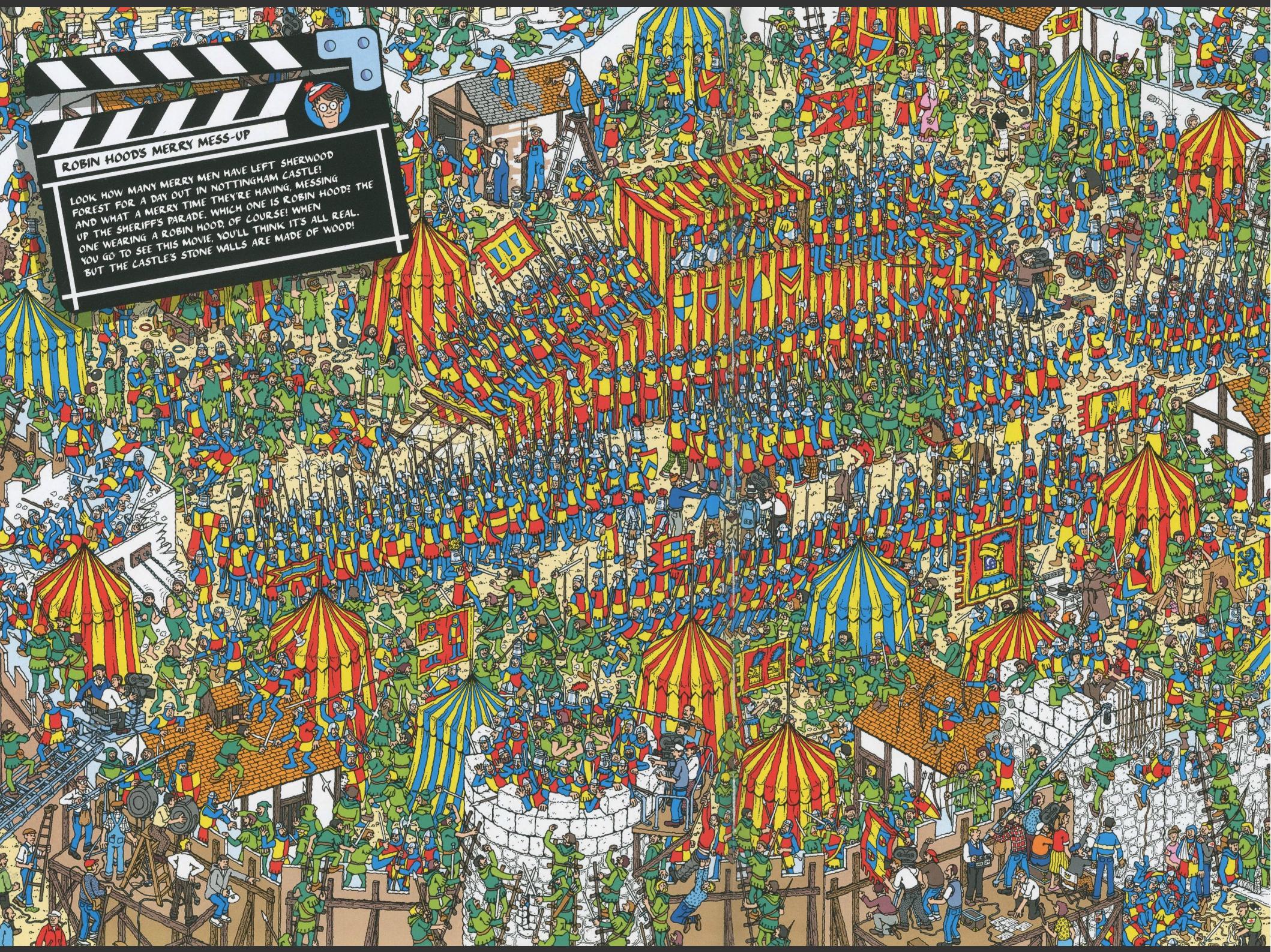


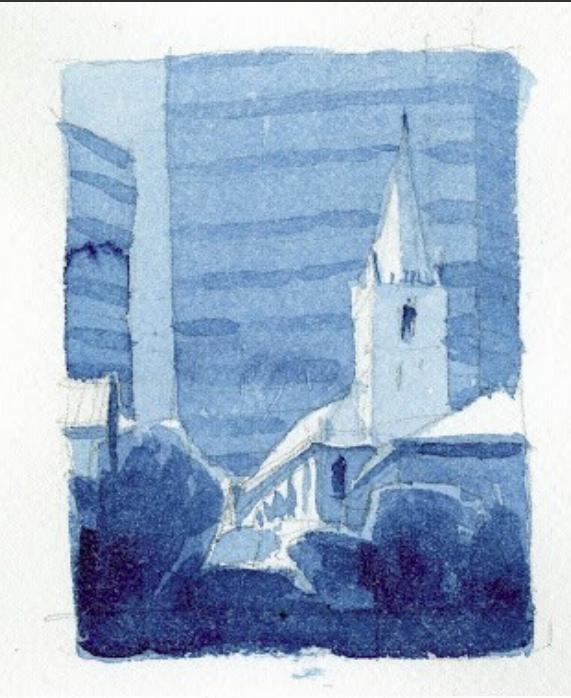
## Story Tools



## Layout

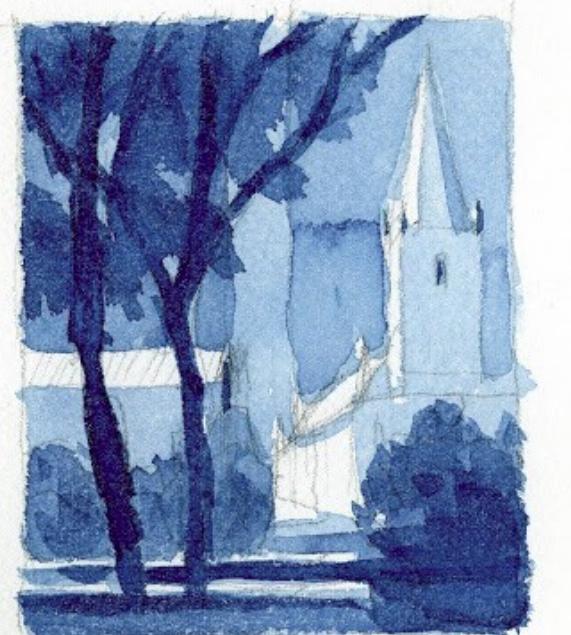
## Color





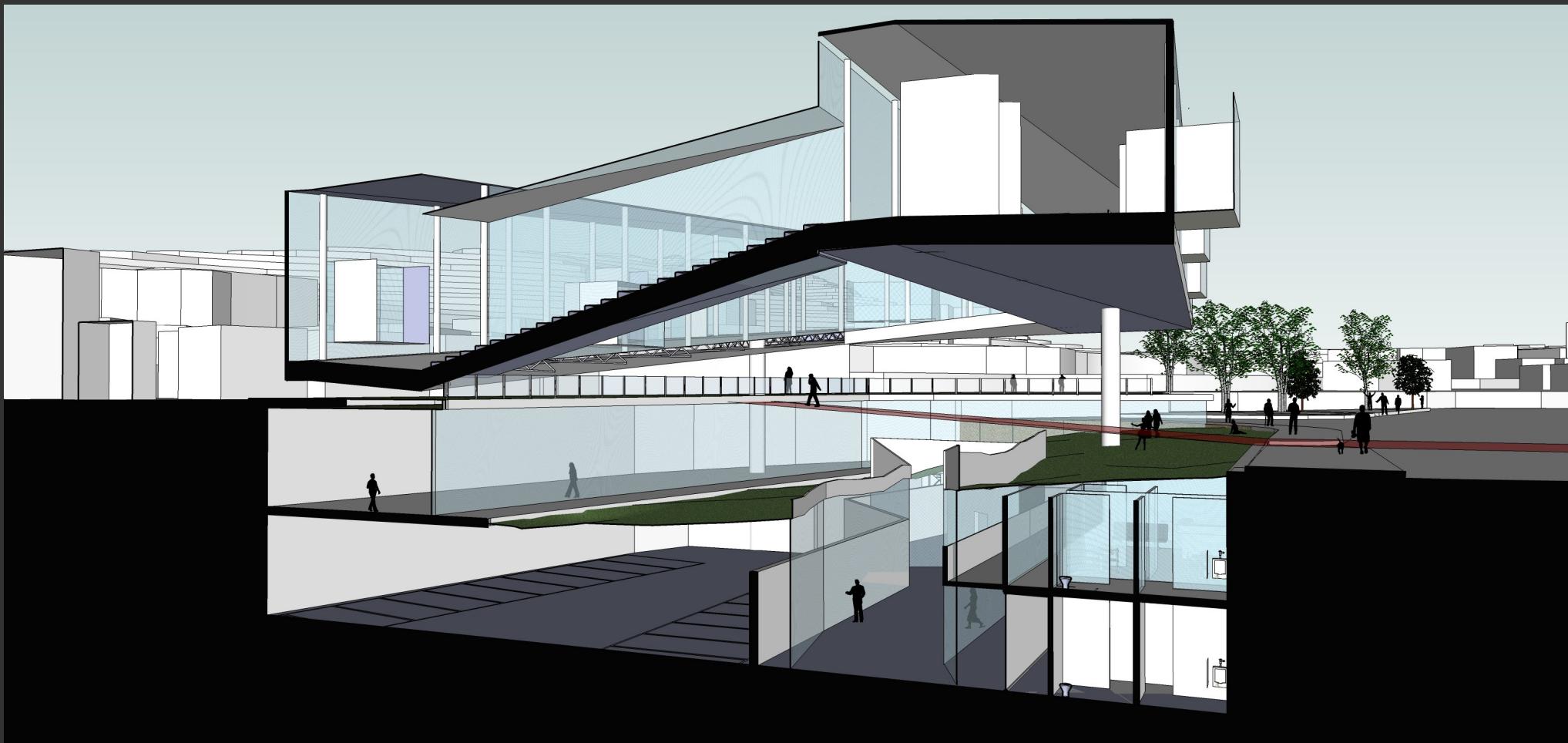
# Does the layout relate the message?

- Clear, visible, up front
- Readable in few sec.
- Keywords highlight the message (or give it context)



Stephanie Bower:  
urbansketchers.org

# Less is more

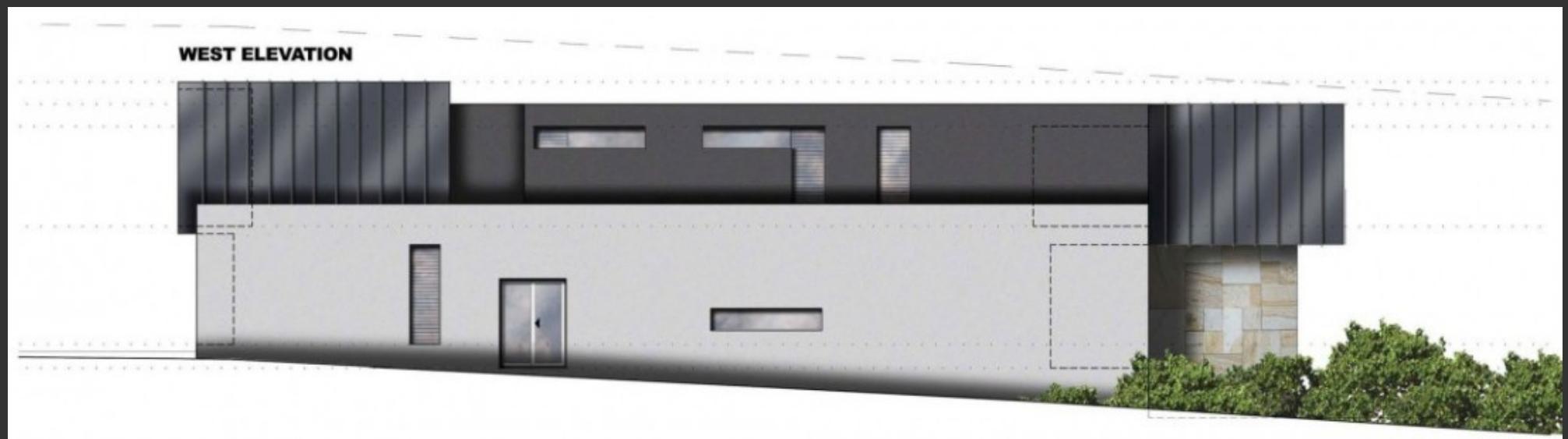
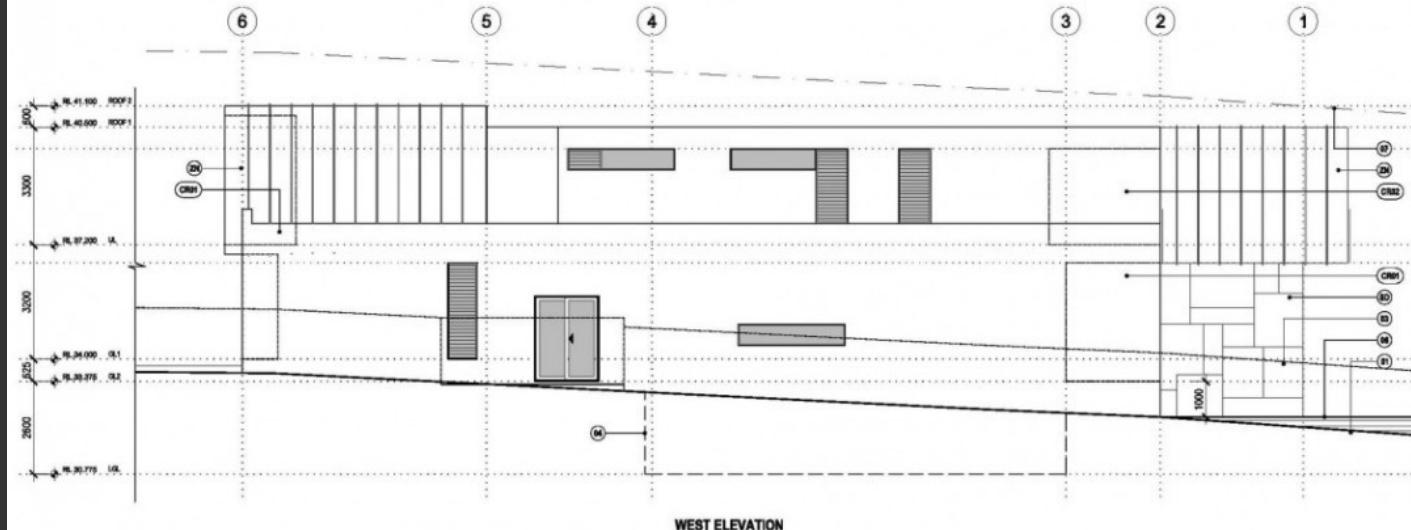


Minu Lee: Sectional perspective of library in Seoul, Korea  
url: [unswbe.wordpress.com](http://unswbe.wordpress.com)

**LEGEND & ABBREVIATION**

CR01 cement rendered & point - Reserve Concrete  
 CR02 cement rendered & point - Reserve Gravel  
 GS thermal insulation blanket  
 NC non-combustible  
 TC weathered red cedar paneling  
 ZH zinc cladding

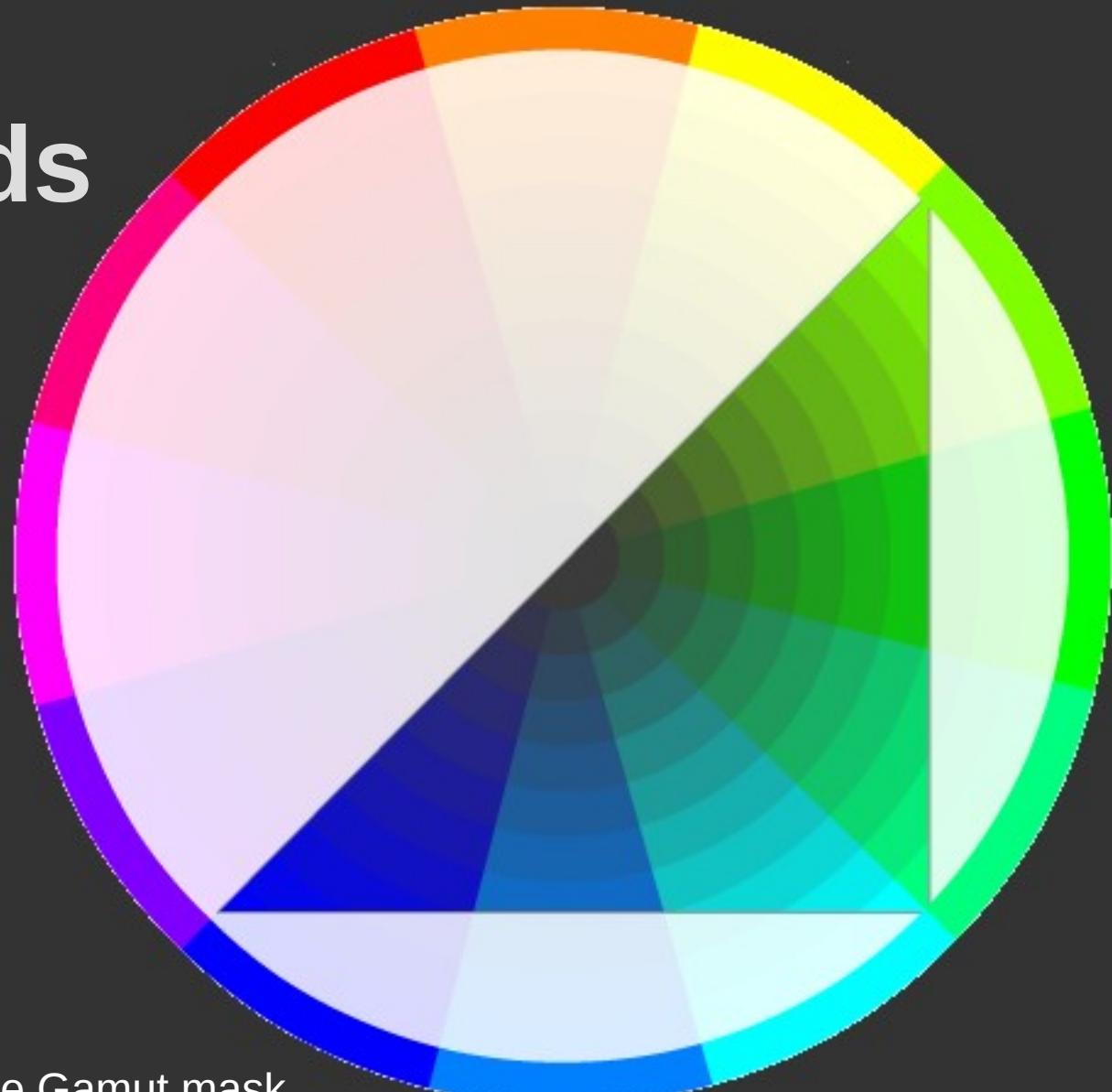
01 line of natural ground level @ boundary  
 02 line of finished ground level @ building face  
 03 line of firebrick/masonry wall @ boundary  
 04 line of roof beyond  
 05 line of roof level  
 06 timber retaining wall to landscaped courtyard  
 07 maximum 8m building height



Modern Box House, Sydney, Australia  
 url: [bravity.net](http://bravity.net)

# Color

- Color > words  
(sometimes)
- Limit color palette
- Contrast



The Gamut mask  
[livepaintinglessons.com/gamutmask.php](http://livepaintinglessons.com/gamutmask.php)

# Color and message

- Color needs to match message
- Connections & consistency

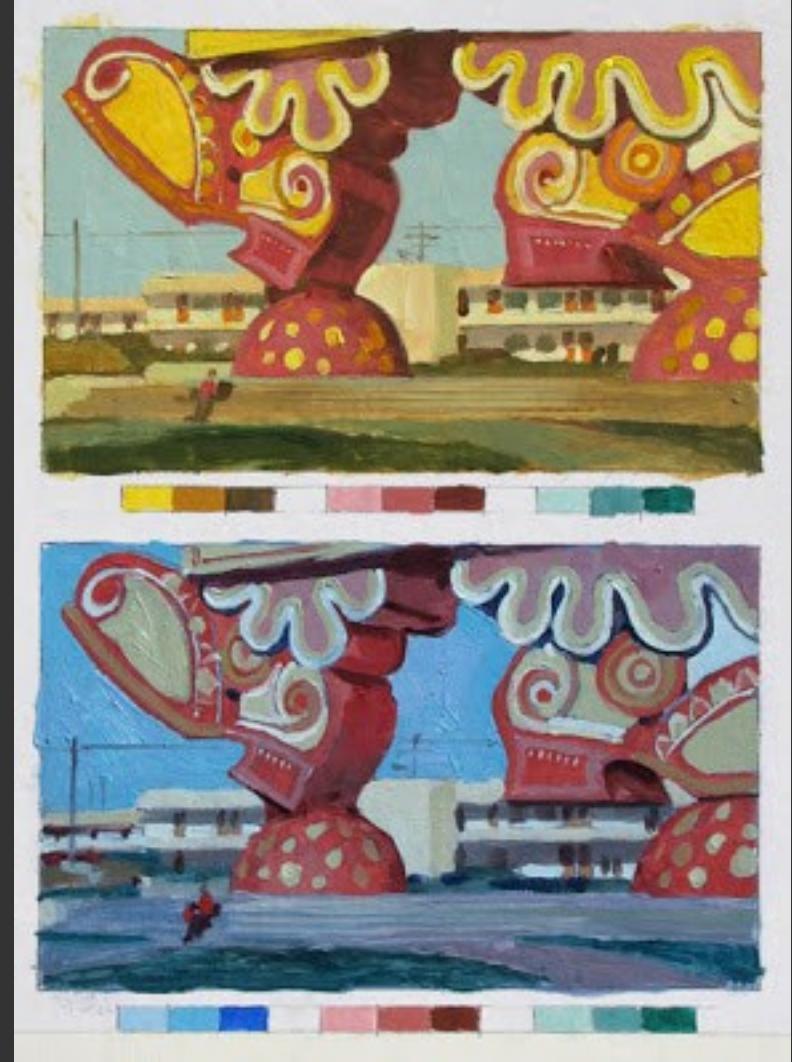
James Gurney  
Colors in Lord of the Rings  
[gurneyjourney.blogspot.nl](http://gurneyjourney.blogspot.nl)

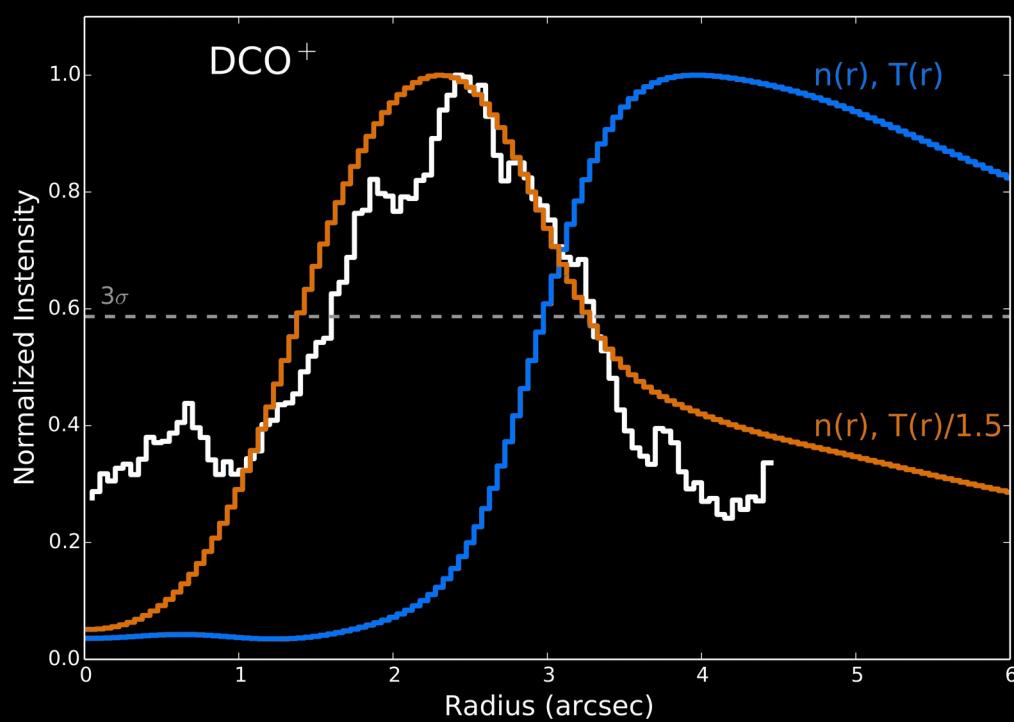
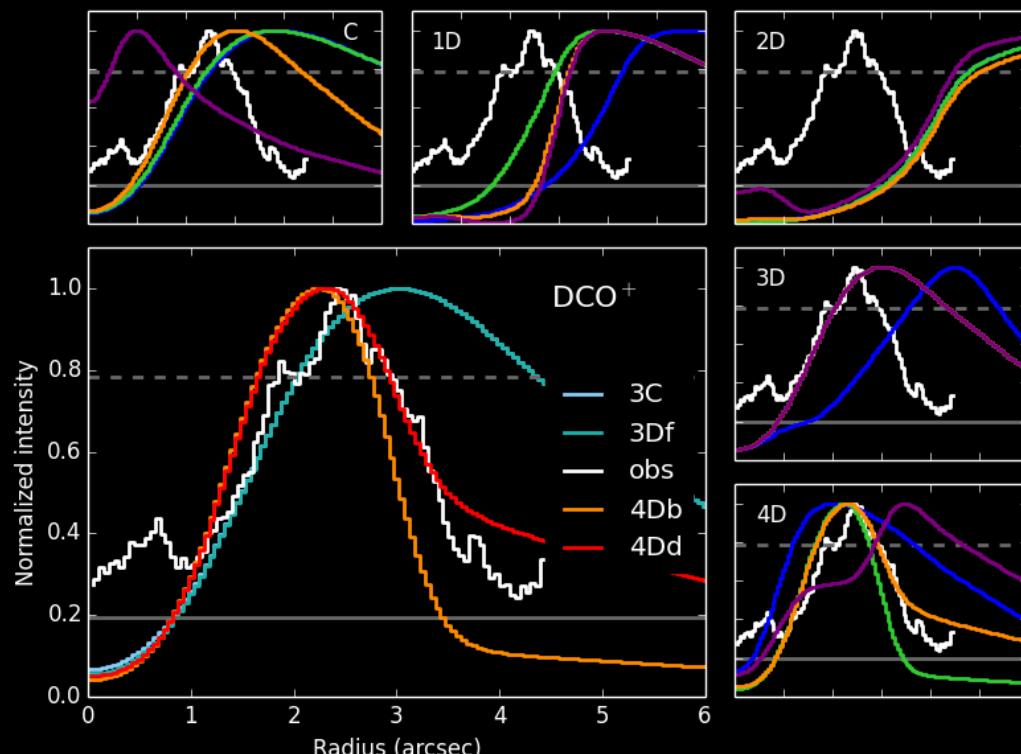


# Color can change the message



James Gurney  
Gamut Masking Method  
[gurneyjourney.blogspot.nl](http://gurneyjourney.blogspot.nl)



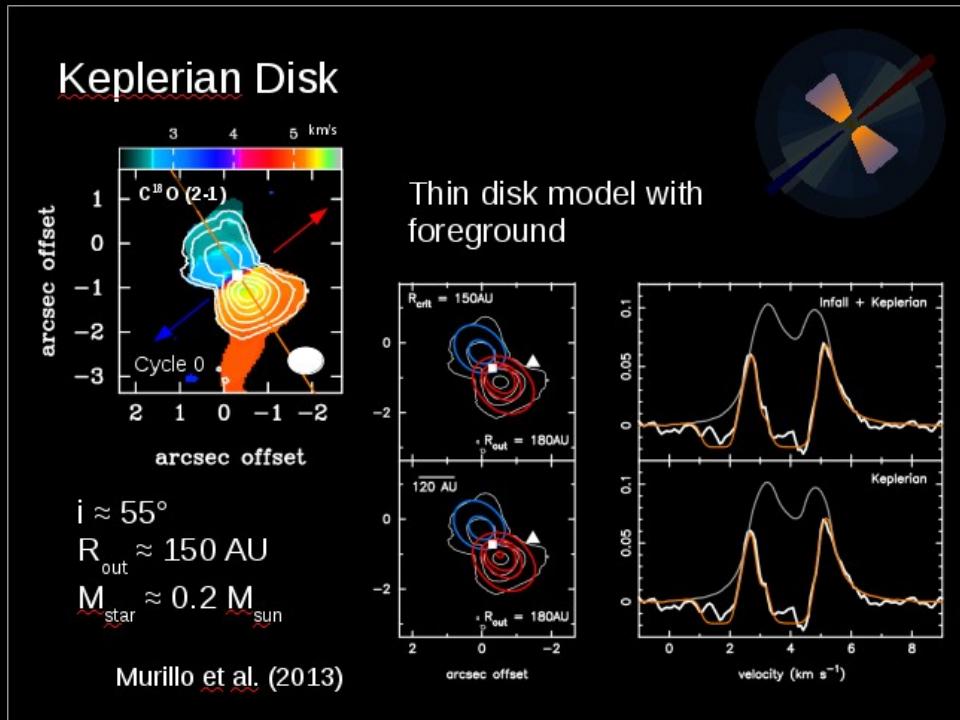
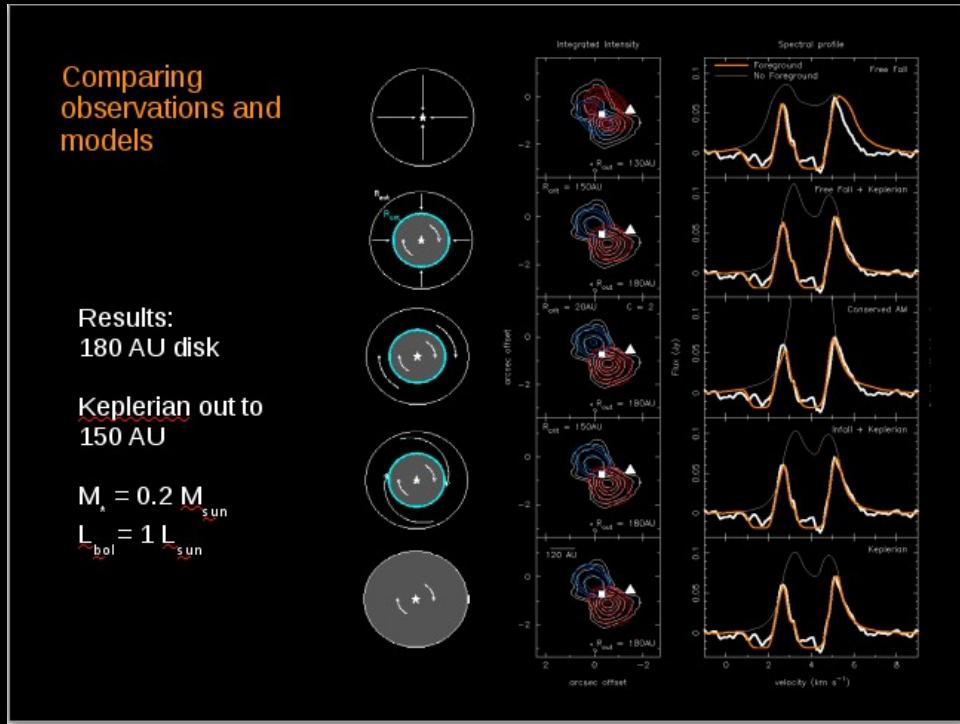


# Bad

(OK~ish for papers,  
with a good caption)

# Good

# Bad



# Good



## Resolving the two outflows from the Class 0 protostellar VLA1623

Nadia M. Murillo and Shih-Ping Lai

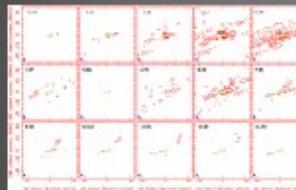
Department of Physics & Institute of Astronomy, National Tsing Hua University

ABSTRACT

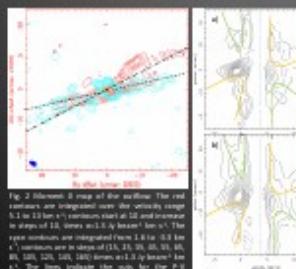
Protostellar outflows are an important part of the star forming process, influencing the protostar's surrounding environment. We study the class 0 protostellar source VLA1623, embedded in the  $\rho$  Ophiuchi cloud. Previous observations have shown that the circumstellar envelope of VLA1623 breaks up into two almost equal point sources in continuum emission at high resolution, with a separation of less than 200AU and very little free-free emission (Looney et al., 2000). This strongly suggests that VLA1623 is a very young binary system, a protobinary system. Our new observations of VLA1623 were done using the Submillimeter Array (SMA) in compact configuration. We traced the outflow in the  $^{12}\text{CO}$  (J=2) line. The overlapping blue and red morphology of VLA1623's outflow causes the outflow to seem complex. Studying the position and characteristics of the lobes in the CO channel map, and comparing it to the extended channel maps of previous studies, we arrive at the conclusion that the complex outflow of VLA1623 is in fact two outflows, one emanating from each source. Here we present a model of the two outflows. The SD and C $^{18}\text{O}$  line emissions closely match with the continuum emission of the circumstellar envelope, suggesting infalling material, in agreement with the fact that VLA1623 is a class 0 protostellar system.

### INTRODUCTION:

Protostellar outflows are one of the first indicators of star formation and can greatly influence the surrounding environment and the formation of a star. VLA1623 is a prototypical class 0 source (André et al., 1990) located in the  $\rho$  Ophiuchi cloud. Previous studies determined that VLA1623 is associated with an extended though somewhat puzzling outflow, showing overlapping red and blue lobes (André et al., 1990). VLA1623 is also associated with the HH object HH113A (e.g. Caratto & Garatti et al., 2006). Several studies have suggested the existence of two outflows as a result of comparing observations in CO and H $\alpha$  (e.g. Dent et al., 1995 and Caratto & Garatti et al., 2006); however, the outflows were not resolved. Continuum emission observations of VLA1623 at high resolution have determined that VLA1623 is very likely a young binary system (Looney et al., 2000), a protobinary system, containing VLA1623A and VLA1623B. From this same observation, A and B appear to be separated by a distance of roughly 200AU. The presence of a binary system supports the argument that the seemingly complex outflow of VLA1623 is in fact two outflows.



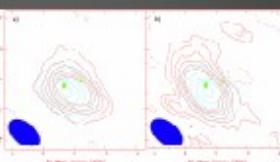
**OBSERVATIONS:**  
Observations of VLA1623 were carried out using the Submillimeter Array (SMA) in compact configuration, using 7 of the 8 antennas, on July 2007. Observations were centered on [16:26:28.349, -24:24:30.0]. The observation provided three lines and continuum:  $^{12}\text{CO}$ , SD and continuum emission in the upper side band and C $^{18}\text{O}$  in the lower side band. The synthesized beam size is 2.34' x 2.36'. Data reduction was entirely carried out using the MIRAD package. The systemic velocity is located at 3.7 km/s. The coordinates of the two sources were taken from Looney et al. 2000.



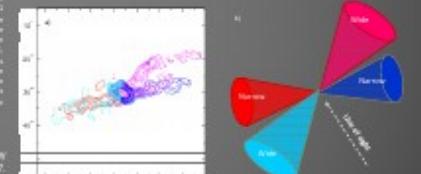
**REFERENCES:**

- André, Martín Pintado, DePoy & Montmerle 1990, A&A, 236, 180
- André, Ward-Thompson, Barsony 1993 ApJ, 406, 122
- Caratto & Garatti, Giannini, Nanni & Lorenzetti 2006, A&A, 449, 1077
- Dent, Matthews & Walther 1995, MNRAS, 277, 193
- Looney, Mundy & Welch 2000, ApJ, 519, 477

# Bad



**MODEL:**  
VLA1623 is very likely a protobinary system. It is then very possible that the source is emitting complex outflow in indeed two outflows, one narrow and one wide. Studying the  $^{12}\text{CO}$  channel map that traces the outflow, we separated the outflow into two bipolar outflows. The criterion used to separate the outflows was based on the characteristic of most outflows to generate a 'leaf' of material or accumulate material at the base of the outflow, i.e. near the source. Following this criterion, the characteristics of the lobes and comparing our maps with maps of previous studies, we 'resolved' the two outflows, each one emanating from one source, and derived a model of the two outflows, shown in figure 5.



**CONCLUSION AND FUTURE WORK:**  
Our observation of VLA1623's molecular outflow shows the overlapping morphology, agreeing with previous studies of the outflow. However, our observations were made closer to the source, showing only a fraction of the much more extended outflow. The resolution of our observation allowed us to resolve the different lobes and confirm the idea that VLA1623 does indeed present two outflows. The red shifted lobes are easier to distinguish, since they seem to be interacting with each other. The blue shifted lobes are more difficult to separate clearly, as they are probably interacting.  
The SD emission in our observation is probably tracing the shock product of the interaction of the two blue shifted lobes. This is suggested by the velocity range 0.17 to 4.4 km/s and position of the SD emission, which closely match the velocity range and position where the lobes show more interaction.  
We expect the C $^{18}\text{O}$  emission (1.5 km/s to 4.9 km/s) is tracing the circumstellar material.  
Although we have determined the red and blue shifted components of the two outflows in this study, we still cannot clearly determine the source of each outflow. Here we have only made an approximation based on the criterion used to separate the lobes. We require further observations of VLA1623 to determine the source of each outflow and if the blue shifted components are interacting.

## Tracing the disk, envelope & outflow cavity of VLA1623 with ALMA

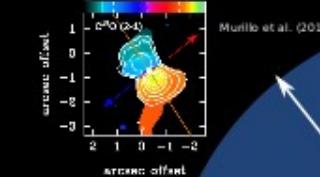
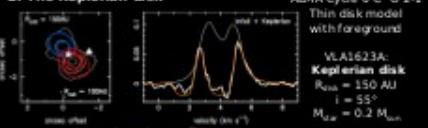


Nadia Murillo<sup>1</sup>, Catherine Walsh<sup>2</sup>, Ewine van Dishoeck<sup>1,2</sup>, Simon Bruderer<sup>3</sup>, Daniel Harsono<sup>3</sup> & Shih-Ping Lai<sup>4</sup>

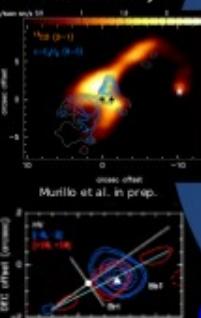
1: Max Planck Institute for Extraterrestrial Physics; 2: Leiden Observatory, Leiden University; 3: Center for Astronomy, University of Heidelberg; 4: Institute of Astronomy, National Tsing Hua University

What is the physical and chemical structure of the envelope and outflow cavity of a deeply embedded protostar? How does this change when a Keplerian disk is involved?

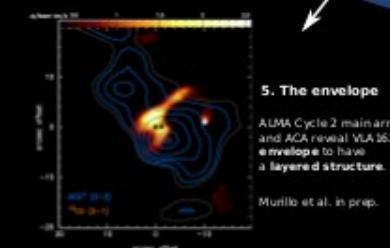
### 2. The Keplerian disk



### 4. The outflow cavity



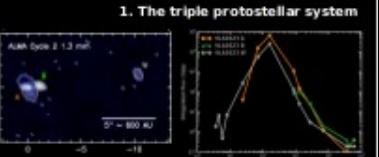
### VLA1623 shows a fast jet in $^{12}\text{CO}$ Santangelo et al. (2015)



### 5. The envelope

ALMA Cycle 2 main array and ALMA reveal VLA1623's envelope to have a layered structure.

Murillo et al. in prep.



VLA1623: Early Class 0 to Class I  
 $p$  Oph:  $d \sim 210$  pc  
 $V_{LSR} = 3.7$  km/s  
Murillo & Lai (2013)

Murillo et al. (2015)

VLA1623's outflow cavity lights up  $^{12}\text{CO}$  like a PDR, with  $\text{C}_2\text{H}_2$  along cavity wall (not disk-envelope interface)

VLA1623W outflow not as strong

Murillo et al. in prep.

VLA1623 shows a fast jet in  $^{12}\text{CO}$  Santangelo et al. (2015)

Murillo et al. (2015)

Modeling of  $\text{DCO}^+$  chemistry shows that temperature needs to be decreased from 24K to 16K behind disk edge to match observations.

Disk midplane shadows the envelope, shifting cold-enhanced molecules closer to the central star

# Good



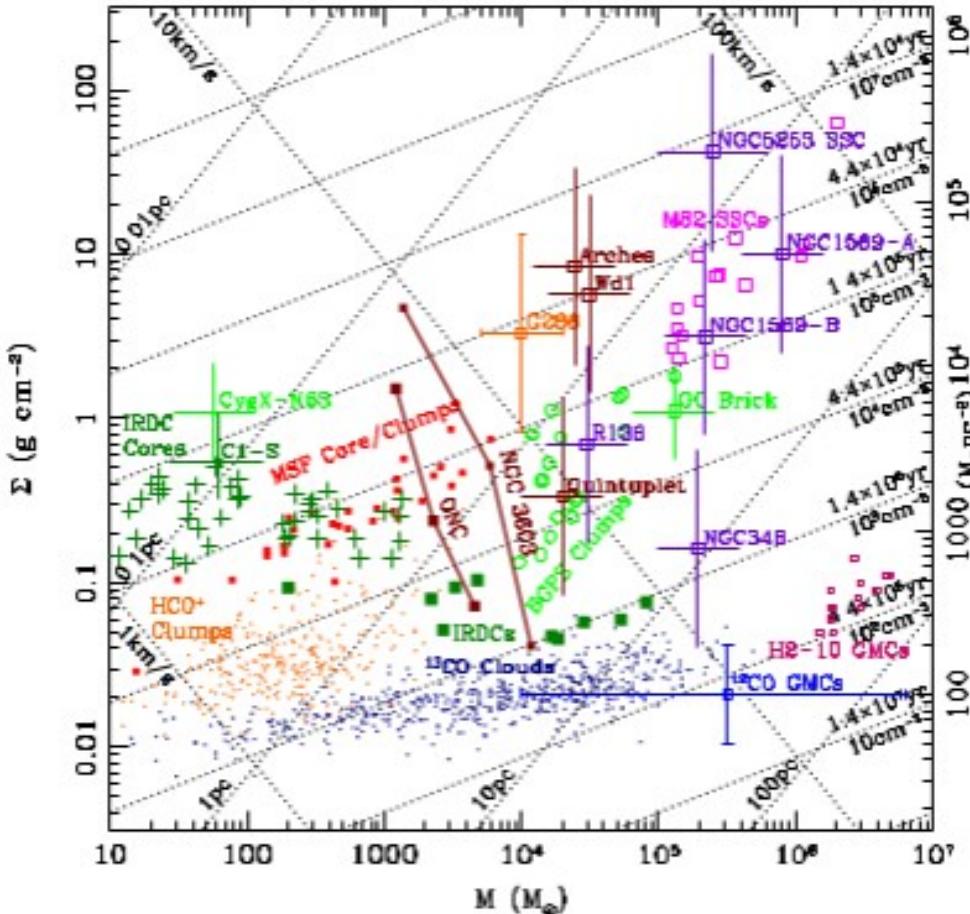


Fig. 1.— The Environments of Massive Star Formation. Mass surface density,  $\Sigma = M/(rR^2)$ , is plotted versus mass,  $M$ . Dotted lines of constant radius,  $R$ , H number density,  $n_{\text{H}}$  (or free-fall time,  $t_{\text{ff}} = (3\pi/[32G\rho])^{1/2}$ ), and escape speed,  $v_{\text{esc}} = (10/c_{\text{MB}})^{1/2}\sigma$ , are shown. Stars form from molecular gas, which in the Galaxy is mostly organized into GMCs. Typical  $^{12}\text{CO}$ -defined GMCs have  $\Sigma \sim 100 M_\odot \text{ pc}^{-2}$  (Solomon *et al.*, 1987) (see Tave *et al.*, 2013a for detailed discussion of the methods for estimating  $\Sigma$  for the objects plotted here), although denser examples have been found in Henize 2-10 (Santangelo *et al.*, 2009). The  $^{13}\text{CO}$ -defined clouds of Roman-David *et al.* (2010) are indicated, along with  $\text{HCO}^+$  clumps of Barnes *et al.*, (2011), including G286.21+0.17 (Barnes *et al.*, 2010). Along with G286, the BGPS clumps (Ginsburg *et al.*, 2012) and the Galactic Center “Brick” (Longmore *et al.*, 2012) are some of the most massive high- $\Sigma$  gas clumps known in the Milky Way. Ten example Infrared Dark Clouds (IRDCs) (Kainulainen and Tan 2013) and their internal core/clumps (Bontorf and Tan, 2012) are shown, including the massive, monolithic, highly-deuterated core C1-S (Tan *et al.*, 2013b). CygX-N63, a core with similar mass and size as C1-S, appears to be forming a single massive protostar (Bontemps *et al.*, 2010; Dearte-Cabral *et al.*, 2013). The IRDC core/clumps overlap with Massive Star-Forming (MSF) core/clumps (Mueller *et al.*, 2002). Clumps may give rise to young star clusters, like the ONC (e.g., Da Rio *et al.*, 2012) and NGC 3609 (Piau *et al.*, 2013) (radial structure is shown from core to half-mass,  $R_{1/2}$  to outer radius), or even more massive examples, e.g., Westerlund 1 (Lin *et al.*, 2013), Arches (Habibi *et al.*, 2013), Quintuplet (Hofmann *et al.*, 2012) (shown at  $R_{1/2}$ ), that are in the regime of “super star clusters” (SSCs), i.e., with  $M_* \gtrsim 10^5 M_\odot$ . Example SSCs in the Large Magellanic Cloud (LMC) (R136, Andersen *et al.*, 2009) and Small Magellanic Cloud (SMC) (NGC 346, Subba *et al.*, 2008) display a wide range of  $\Sigma$ , but no evidence of IMF variation (red box). Even more massive clusters can be found in some dwarf irregular galaxies, such as NGC 1569 (Larsen *et al.*, 2008) and NGC 5253 (Turner and Beck, 2004), and starburst galaxy M82 (McCrady and Graham, 2007).