# **HI Studies of the Closest GRB host galaxy**

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**Bimodal Distribution** 

*Short GRBs:* < a couple of seconds

*Long* **GRBs:** > a couple of seconds



**Bimodal Distribution** 

**Production** 

*Short GRBs:* < a couple of seconds

Merging binary systems

*Long GRBs:* > a couple of seconds

**Core-collapse of massive stars** 



**Bimodal Distribution** 

**Production** 

Gravitational Wave

Short GRBs: < a couple of seconds

**Merging binary systems** 

*Long GRBs:* > a couple of seconds

**Core-collapse of massive stars** 



**Bimodal Distribution** 

**Production** 

*Short GRBs:* < a couple of seconds

**Merging binary systems** 



**Core-collapse of massive stars** 

Star Formation

#### **Beacons of Star Formation**

- Located in actively star forming regions
- Young stellar population
- SN-GRB connection



Fruchter+2006



# **Probes of Galaxy Evolution ...**

- Located in actively star forming regions
- Young stellar population
- SN-GRB connection
- ★ Detectable up to high redshift (z > 8)
- ✤ Independent of galaxy luminosity

How they sample SF galaxies or In which environment they form



Fruchter+2006



#### **More star formation**

**—** More massive star

→ More GRBs

#### **Tracers of Cosmic Star Formation?**

More star formation → More massive star → More GRBs



## **Metal Poor Environments?**

Not linked to overall SFR

How about metallicity?

- Low mass / metallicity hosts
- Top Heavy IMF



# **Metal Poor Environments?**

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**Metal rich GRB hosts** 



Perley+2016

#### **\*** More massive stars

e.g., Schneider+2018, Zhang+2018

**\* More massive stars** 

- High  $\Sigma_{SFR}$
- High sSFR values
- Powerful outflows



#### **Regions with high densities of SFR common in interacting systems**

**GRB hosts commonly interacting systems?** 

Structure and kinematic of gas

GRB 980425 / SN 1998bw z = 0.0087

- M\* = 10<sup>8.7</sup> M<sub>Sun</sub>
- SFR = 0.45  $M_{sun}$  yr<sup>-1</sup>
- 12 + log[O/H] = 8.27
- Massive stars < 8 Myr

★ No interacting companion was found (Foley+2006)



#### **Closest Known GRB Host**



#### **Closest Known GRB Host**

# **10 hours on-source 30** antennas of the GMRT



# **Total Intensity Map of HI**



 $M_{HI} = 10^{8.9} M_{sun} \sim 1.6 M_{*}$ 

# **Total Intensity Map of HI**



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#### **GRB environment:** $N(HI) = 10^{21} \text{ cm}^{-2}$



# **Velocity Map of HI**



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# **Channel Map of HI**



More than 20% of the gas not rotating with the gas disk

#### Arabsalmani+2015, Arabsalmani+ about to be submitted

# Interaction ...















 $M_{HI} = 10^{7.1 M} sun \sim M*$ 



 $SFR = 0.004 M_{sun} yr^{-1}$ 

#### **Massive stars < 10 Myr**



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# To Explore ...



z = 0.040

 $\cap$ 

#### Large sample with future radio telescopes

# **Quick Summary**

- **☆** GRBs: Beacons of star formation
- ★ SFR density, the likely driver
- **A** GRB hosts, interacting systems?
- ★ Ongoing interaction in the closest GRB host







#### **Gamma Ray Bursts**

