

THE HOST GALAXY OF FRB 121102

PULSAR ASTRONOMERS VENTURE OUTSIDE THE MILKY WAY

Shriharsh Tendulkar (McGill University),
Cees Bassa (ASTRON),
and a lot of people here



KECK FIELD

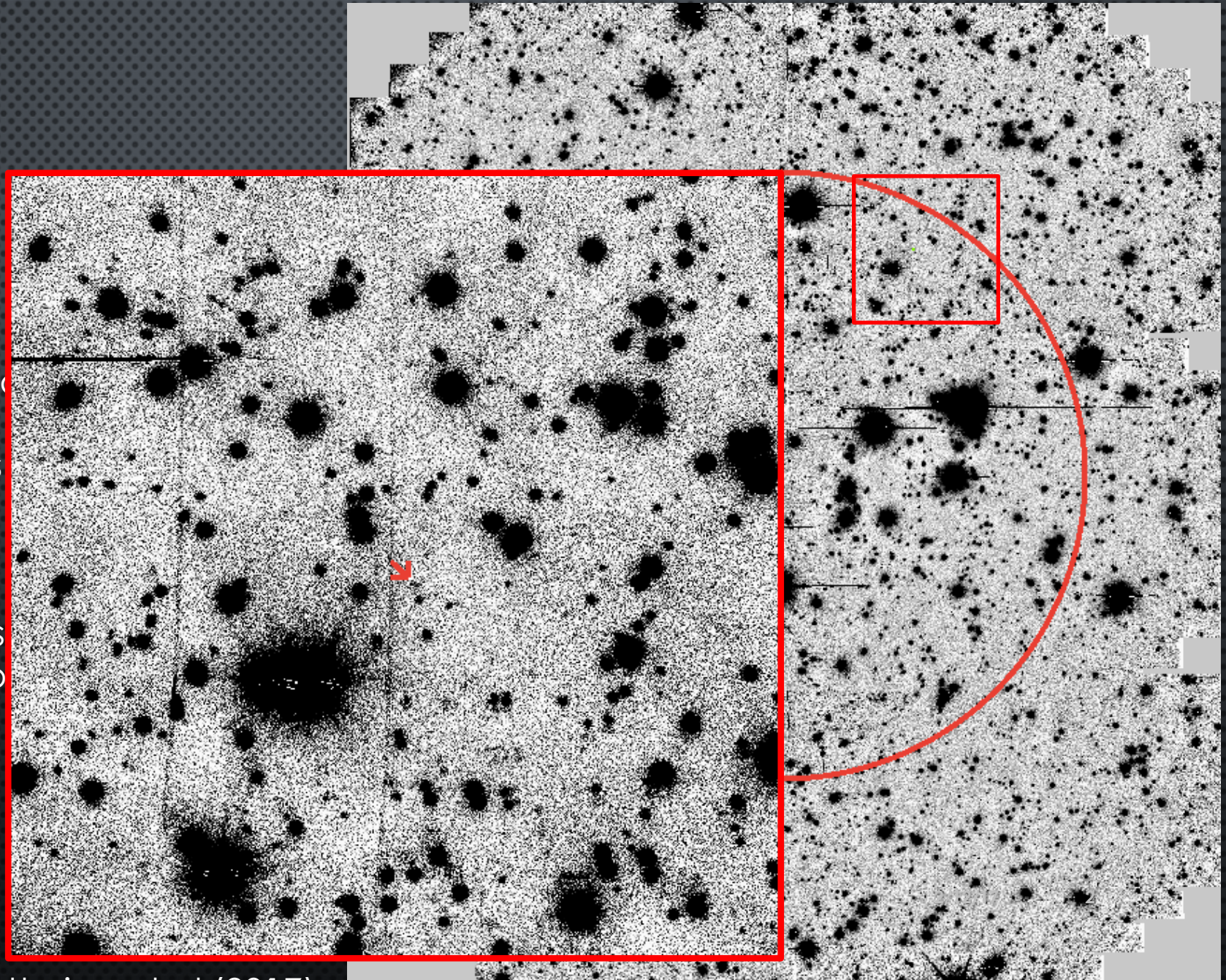
Localization! Localization! Localization!

Lots and lots of potential hosts

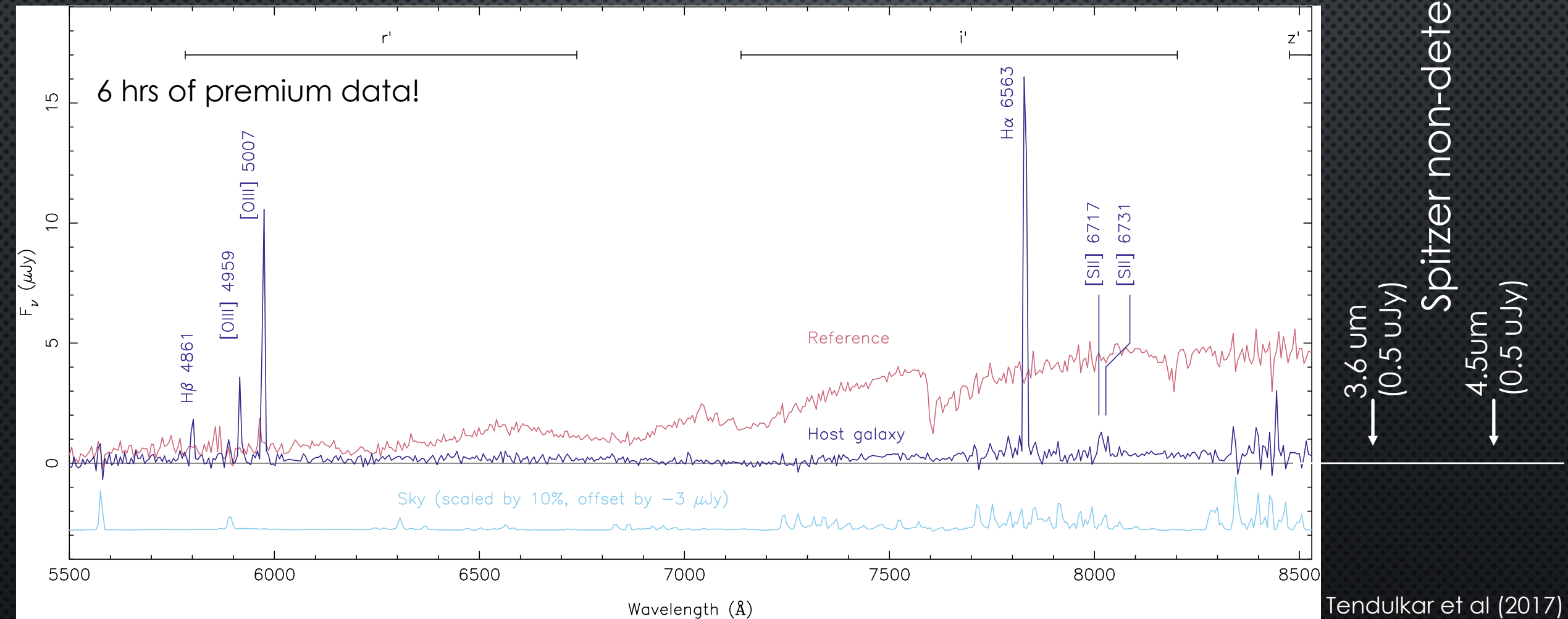
Also, many radio counterparts
Few weak X-ray sources (Schroeder et al 2017)

Aspen 2017 Shriharsh Tendulkar

Chatterjee et al (2017)

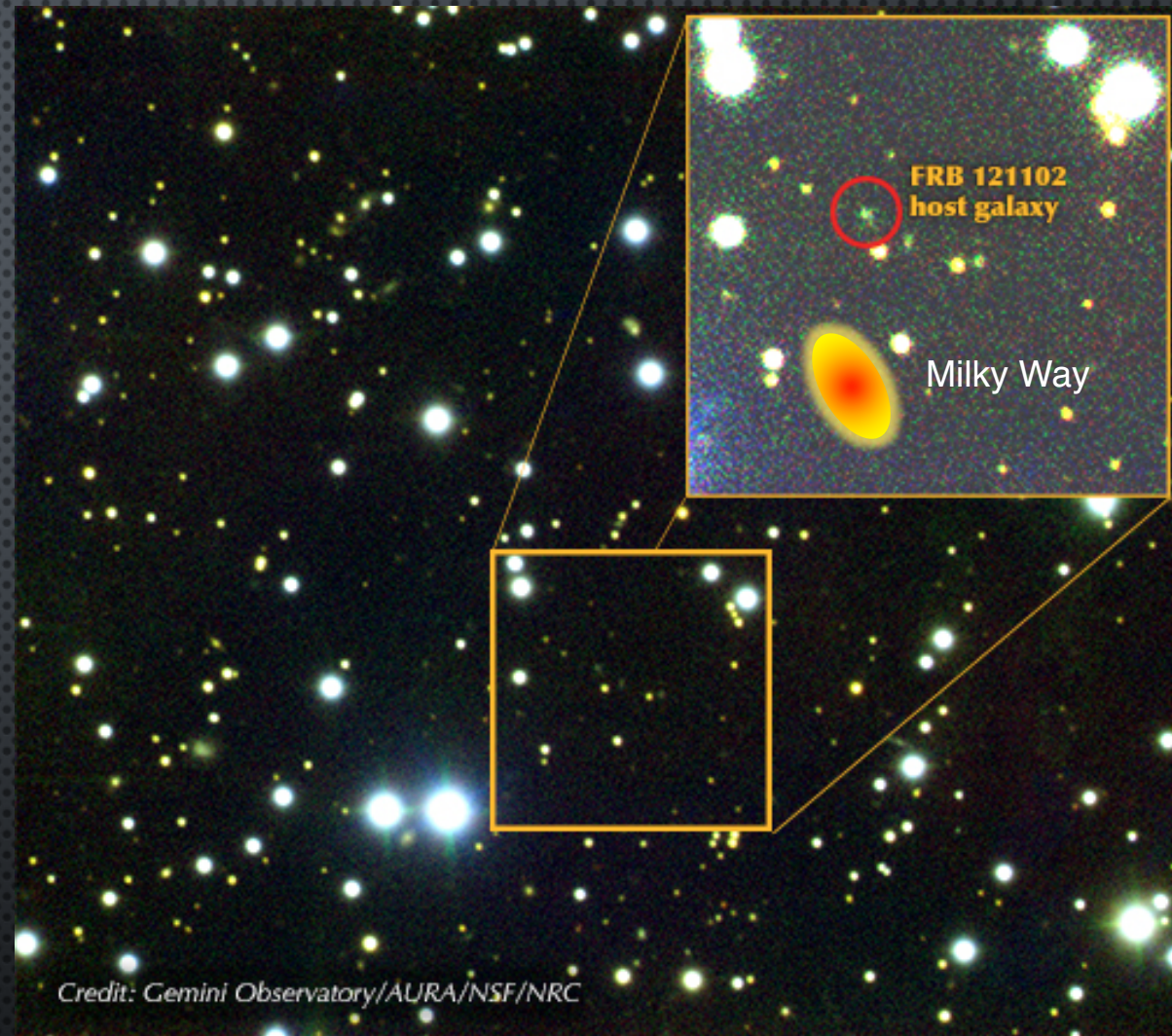


- PHEW, NOT ABSORPTION
- INCREDIBLY BRIGHT EMISSION LINES! — HIGH SFR
- R & I BANDS DOMINATED BY [OIII] AND H α , Z BAND IS CONTINUUM



INFERRED PROPERTIES

- $z = 0.19273$
- SIZE ~ 4 KPC
- $M_* \approx 4\text{--}7 \times 10^7 M_{\text{SUN}}$
(INCLUDES EMISSION LINES, MIGHT BE LOWER)
- $\text{SFR} \approx 0.5 M_{\text{SUN}}/\text{YEAR}$
- METALLICITY: $12 + \text{LOG}(\text{O}/\text{H}) < 8.7$
- $\text{DM}_{\text{HOST}} < 300 \text{ PC/CC}$ (FROM HALPHA)

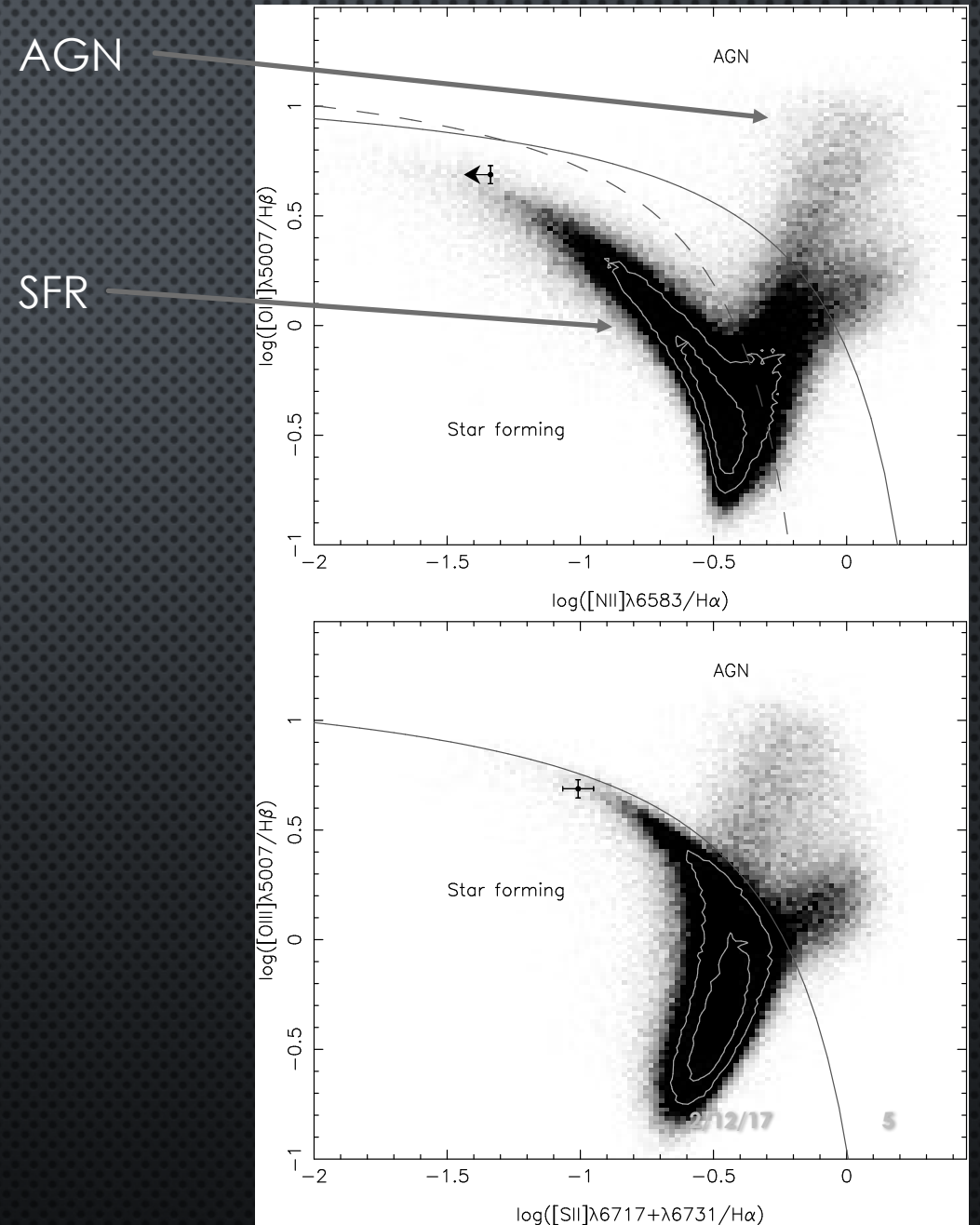


Tendulkar et al (2017)

BPT DIAGRAM

- (BALDWIN, PHILIPS & TERLEVICH)
- LINE RATIOS DIAGNOSTIC OF AGN/SF
- NOT VERY WELL CALIBRATED FOR DWARFS
- 0.5% OF DWARFS SHOW AGN SIGNATURES IN OPTICAL! (REINES ET AL. 2013)
- NOT VERY CONCLUSIVE

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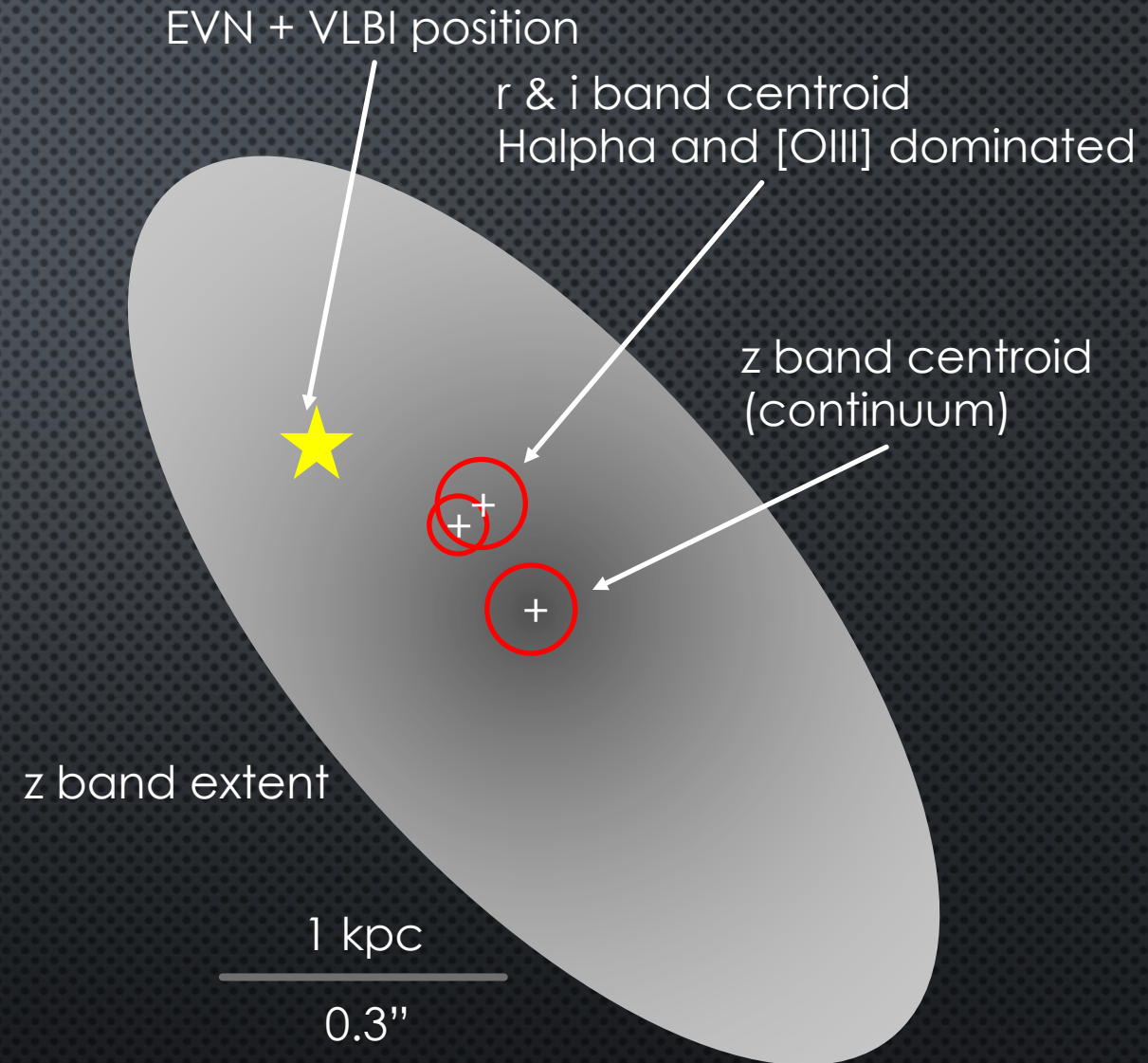


Tendulkar et al (2017)

ASTROMETRY

- ~1-2 MAS FRAME-TIE (GAIA FTW!)
- EVN OFFSET – 286 MAS
- R & I BAND OFFSET – 160-190 MAS
- BRIGHT KNOT OF HALPHA? HII REGION/SNR
- GETTING HST IMAGES (NEXT WEEK)
 - HALPHA ON/OFF, 1.1 & 1.6 MICRONS

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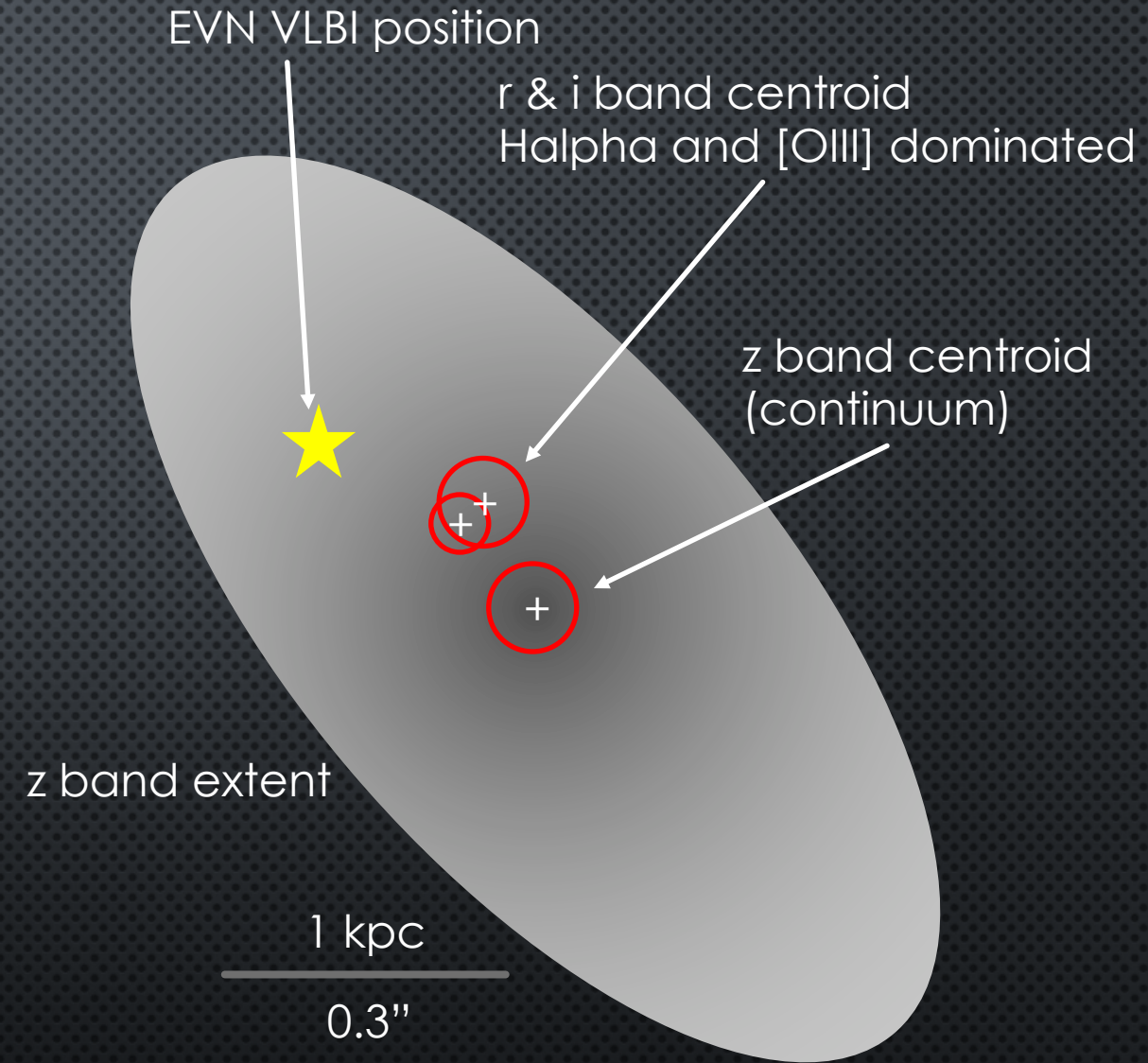


2/12/17

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WHAT IS THE PERSISTENT SOURCE?

- AGN?
BUT UNCOMMON, NO SIGNATURES, FRB MECH?
NO X-RAYS
- NON-OPTICAL CONFIRMATION?
- WIND NEBULA/SUPERNOVA REMNANT?
INCREDIBLY BRIGHT, VARIABILITY?



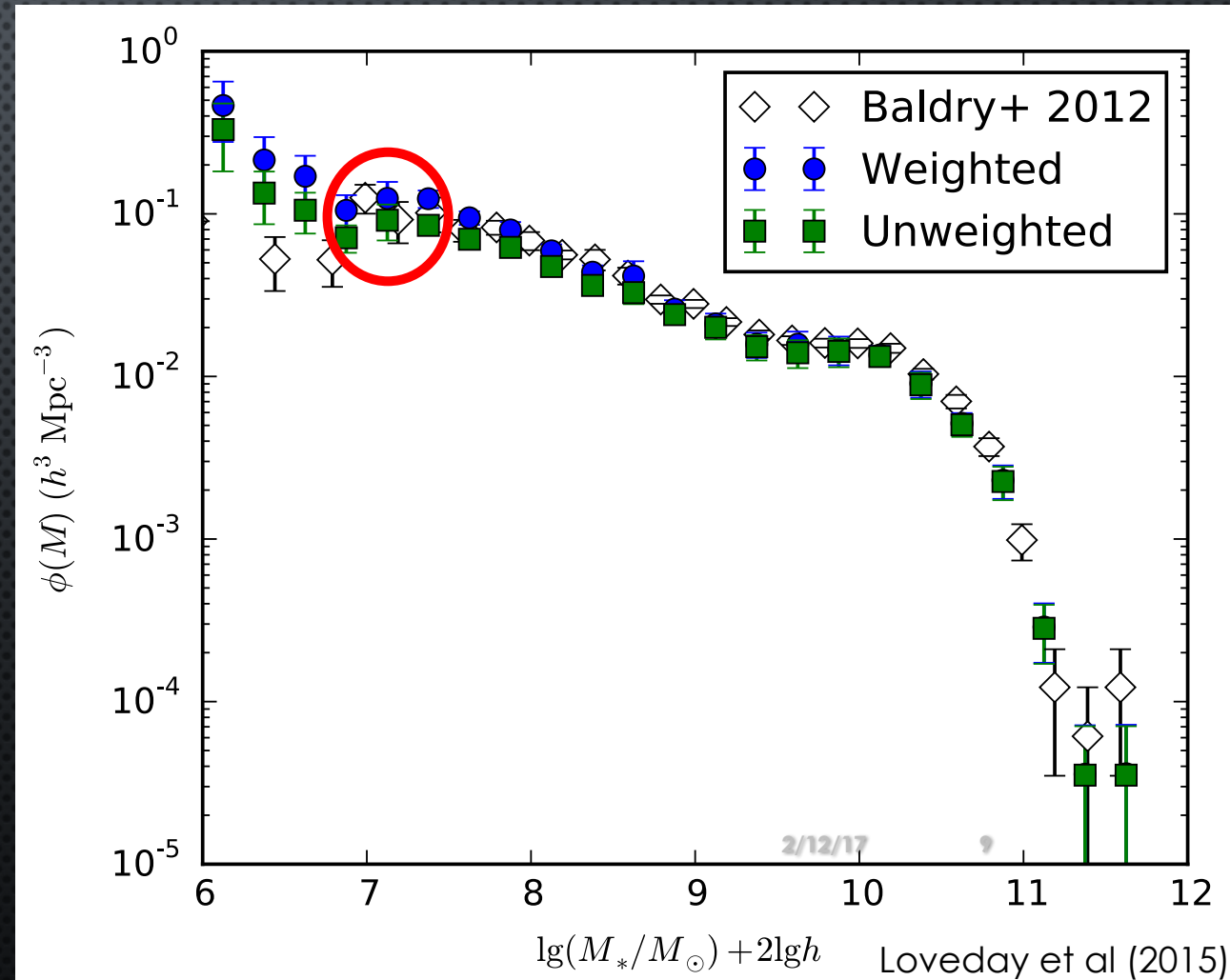
WHY DWARFS?

- DWARFS HAVE FEW % OF STARS + NEUTRON STARS
- WHY IS THE FIRST LOCALIZATION IN A DWARF?
- EXACTLY LIKE THE HOSTS OF LGRBs & SLSNe-I (METZGER ET AL 2017, KOHTA & MURASE 2017)
 - MAGNETAR UNIFICATION MODEL (NEEDS LOW METALLICITY)

FINDING NEEDLES IN NEEDLE STACKS

- ASSUMING THE FRB-DWARF CONNECTION
- DWARFS ARE EXTREMELY COMMON
- FROM DM, ESTIMATE $z \pm 0.1$
- STILL LOTS OF POSSIBLE HOSTS!

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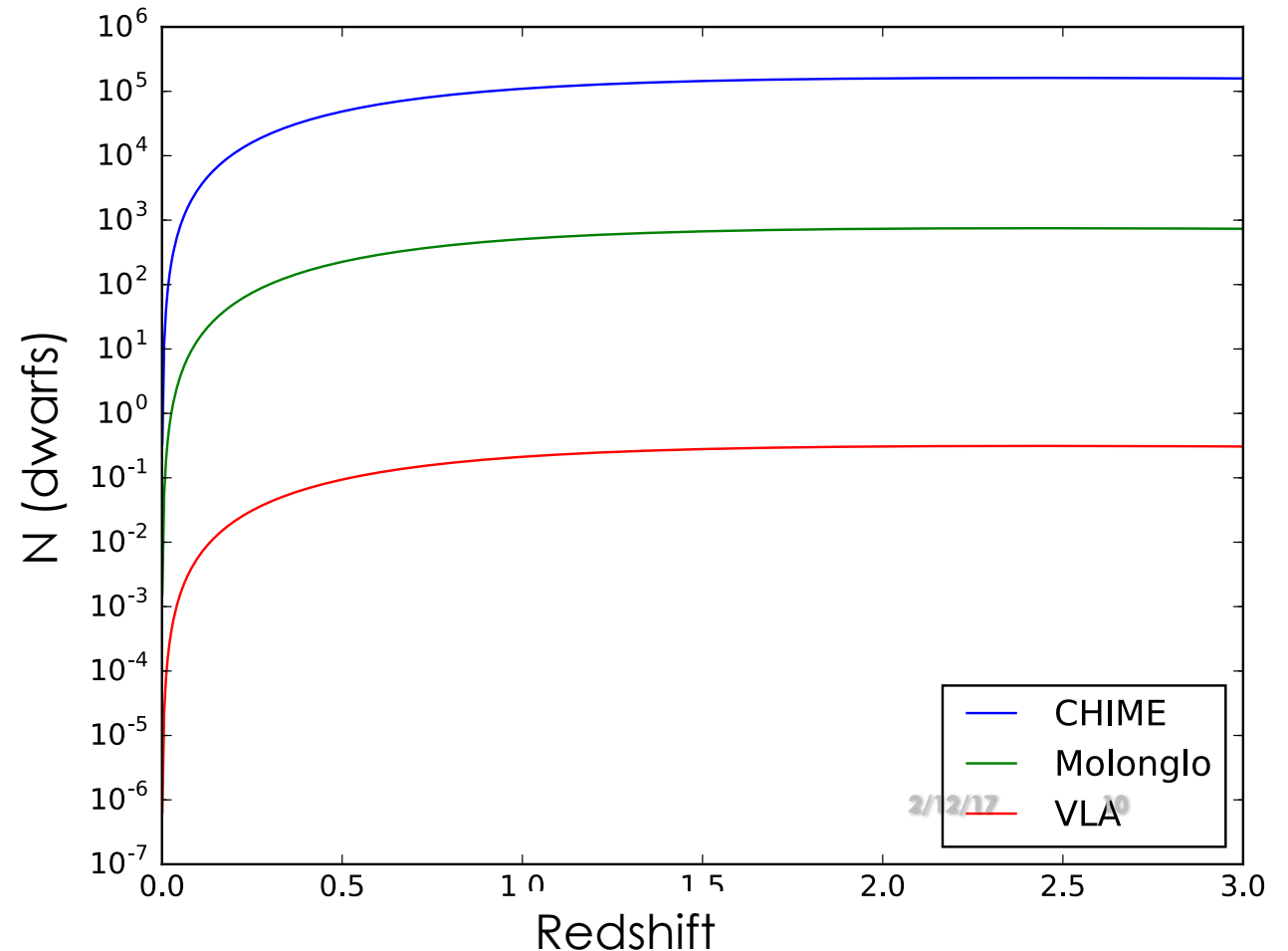
FINDING NEEDLES IN NEEDLE STACKS

Number of dwarf galaxies in the primary beam

Assuming a redshift window of 0.1

Absolutely need intererometric localization!

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FAINTNESS ISSUE

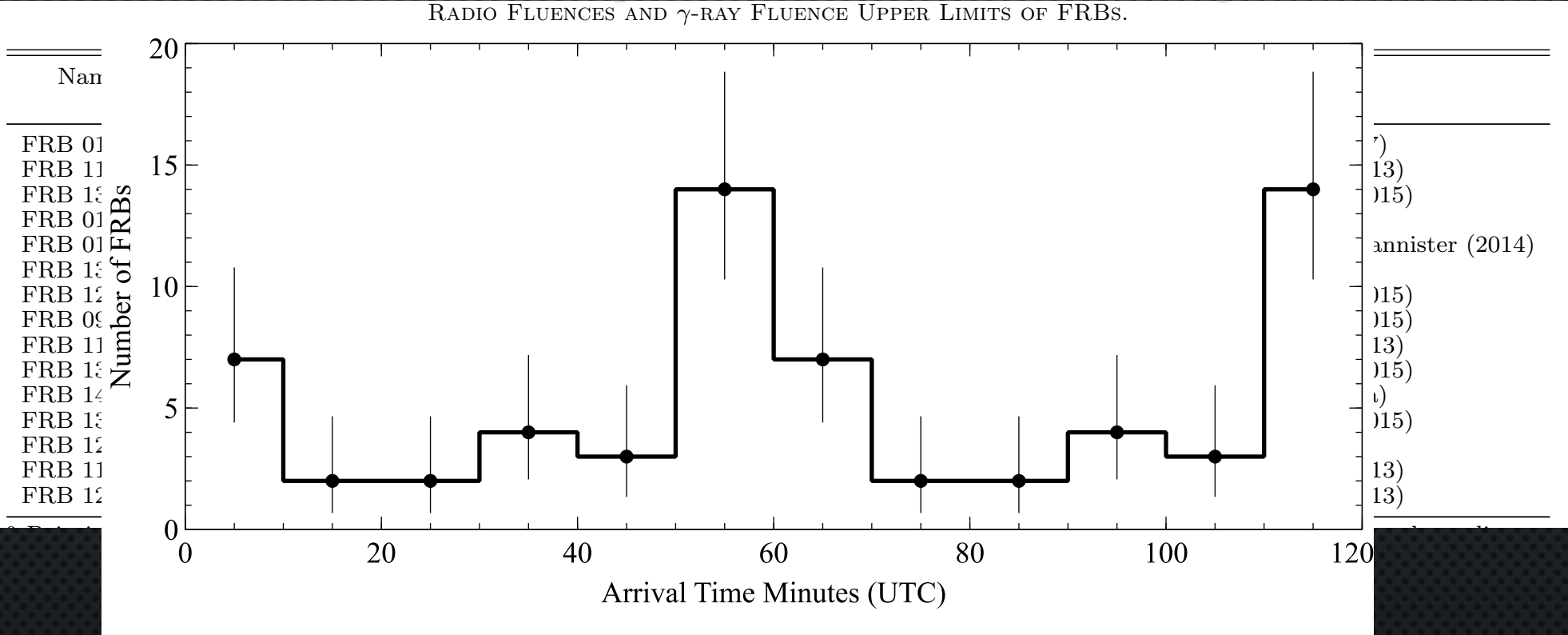
- DWARFS ARE FAINT!
- $M_{AB} = -16$ (TYPICAL)
- AT $z = 1$ ($DM_{EXCESS} = 1200$)
 - $M_{AB} = 28$!
- HOW DO WE OPTIMIZE SEARCHES FOR FRB HOSTS?
- WOULD THE PREFERENCE FOR DWARFS REDUCE AT HIGHER z ?
- 21 CM ABSORPTION? (FREQ COVERAGE SPECIFIC)

SLSNe redshifts are measured from the SLSNe, which are much brighter.

LGRBs often have bright afterglows.

Here, we have to depend on the galaxy.

FRB NUMEROLOGY (TYPE II PERYTONS?)



FUTURE & DISCUSSION

- **FOR FRB 121102**

- GET METALLICITY (VIA [OII] LINES?)
- HST IMAGING (STRUCTURE, LOCATION)
- NEIGHBORHOOD (FIELD/OVERDENSITY)
- X-RAY BURSTS?

- **DISCUSSION**

- HOW TO OPTIMIZE HOST SEARCHES?
- SYNERGY BETWEEN NEW RADIO PROJECTS AND UPCOMING LARGE TELESCOPES (ELTs, JWST ETC) (OPTICAL BURSTS?)