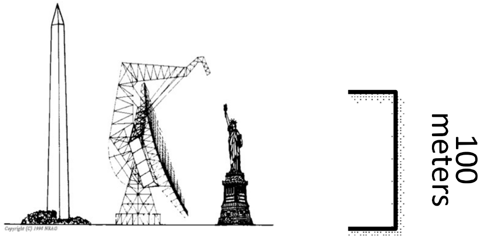
FAST
THE WAKING GIANT

Marko Krčo, Di Li, Duo Xu, Ningyu Tang

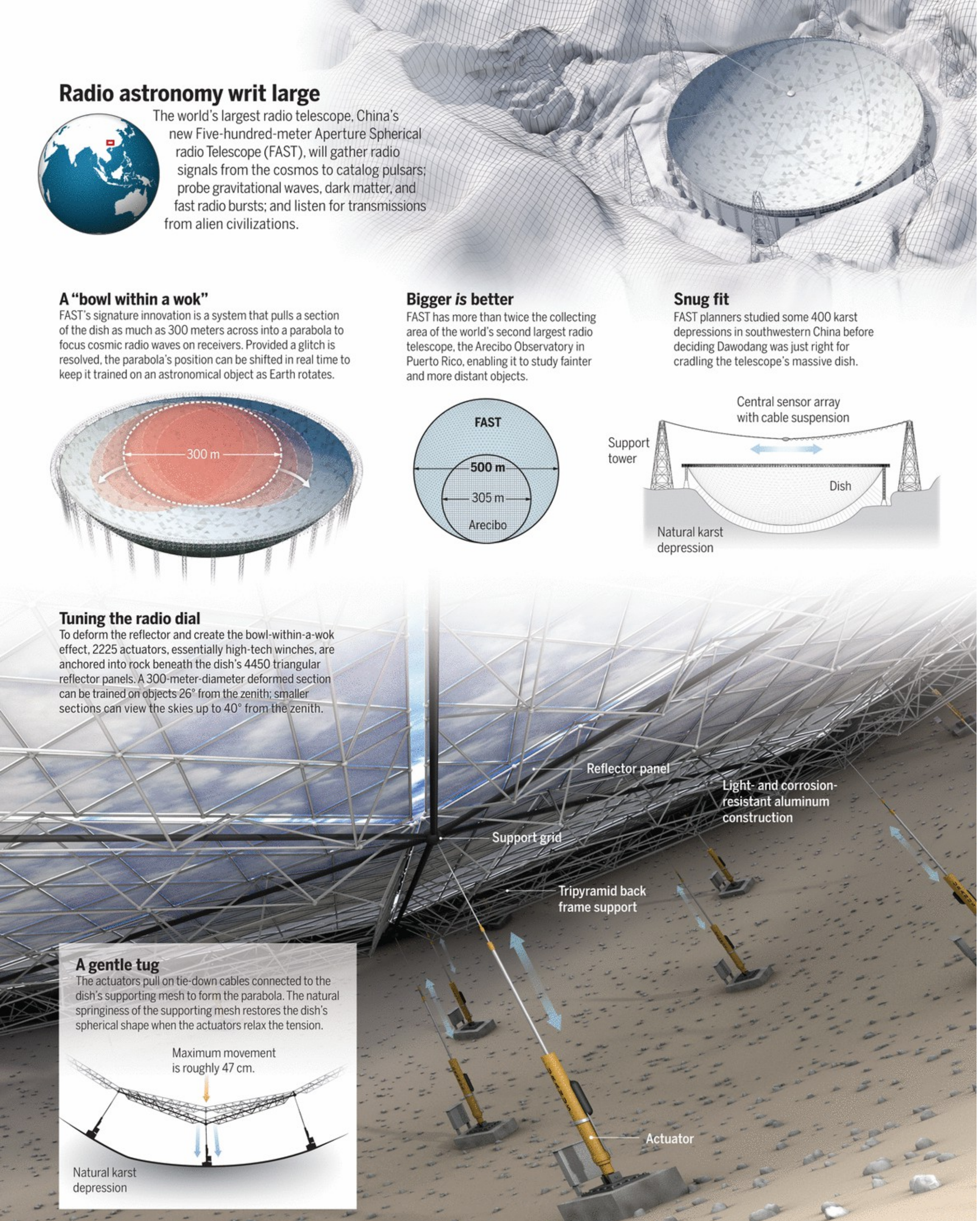
Five-hundred-meter **A**perture **S**pherical radio **T**elescope (**FAST**)



GBT
100 m

FAST
(2016.5)
500 m

Arecibo
300 m



(Science Magazine, Sep. 2016)

7 sets of frontend

No.	Frequency range[a] (MHz)	Number of Beams	Polarization Mode[b]	System Temperature[c]
1	70-140	1	RCP & LCP	1000
2	140-280	1	RCP & LCP	400
3	270-1620	1	RCP & LCP	150
4	560-1020	1	RCP & LCP	60
5	1100-1900	1	RCP & LCP	25
6	1050-1450	19	X & Y linear	25
7	2000-3000	1	RCP & LCP	25

Timeline

- **Project Approval:** Dec., 2007
- **Commence Construction:** March, 2011
- **Openning ceremony:** Sep. 25, 2016

- **19 beam L-band array**: to be delivered in Dec., 2016
- **Backend upgrade (for commensal survey):**
  - under development, to be expected in Spring of 2017
- **Commissioning:** 2016 - ~2018
- **Operation:** ~2019

Constraints on FAST

FAST is slow.

- Slewing time: 1.5min - 10min
- Beam and FOV: 3' in L-band, ~26' with 19 beam
- Drift Scan: only feasible mode for large surveys in early years
- Sky coverage: DEC -14° to 66° (-1° to 52° with full gain)
- Confusion limited: in 1 s @ ~1 mJy
- VLBI/Timing: moving phase center?

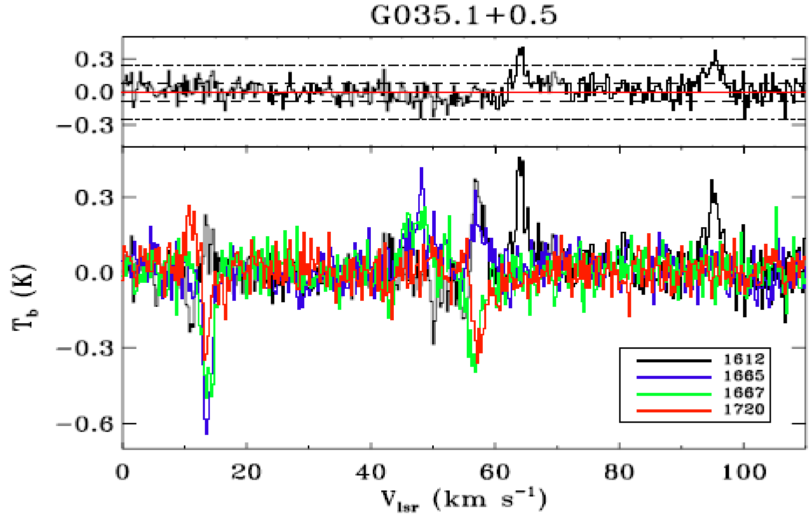
INCOMPLETE LIST OF PLANNED PROJECTS:

- (HIFAST) Galactic HI Emission/Absorption Survey
  - Two drift passes at ~200 days each, starting summer 2017
  - 2.9'/~26' beam, ~10 mJy at 0.1 km/sec
  - 1 BILLION voxel HI map, ~2000 km/sec bandwidth
  - Commensal with Pulsar, FRB, and Extra-Galactic Surveys
- Deep Orion Spectral Line Survey
  - Search for undetected molecules
- OH IR Circumstellar Maser Survey
- Dark Gas Survey
  - Heiles & Troland, 2003 (Arecibo, 79 sources)
  - FAST: 800 quasars in 5 years (4 hrs/source)
- OH Mega-Maser Search
  - FAST has 2.3X Arecibo Sky; Growing IR Galaxy Catalogs

OTHER NOTABLES:
~2000 new pulsars (Improved IPTA), LIGO-FAST-VIRGO (~40-200 hours/FRB),
reionization timing and power (~5-10 new local group gas-rich dwarfs),
The Cosmic Web (10^{16} sensitivity with 8 hours), Breakthrough Initiative, LOFAR Collaboration?

OH Survey Along Sightlines of Galactic Observations of Terahertz C+

- Beam size ≈3’ (Arecibo telescope)
- Galactic longitude range (32°,64°) (189°, 207°)
- OH sensitivity: σ ≈ 35 mK
- 151 OH components toward 51 sightlines of GOTC+



- All OH emissions conform to ‘Sum Rule’

$$T_{\rm b}(1612) + T_{\rm b}(1720) = T_{\rm b}(1665)/5 + T_{\rm b}(1667)/9.$$

- A correlation was found between C+ intensity I(C+) and N(OH) for CO-dark molecular clouds, consistent with C+ and OH being useful tracers of H_2 in CO-dark clouds.

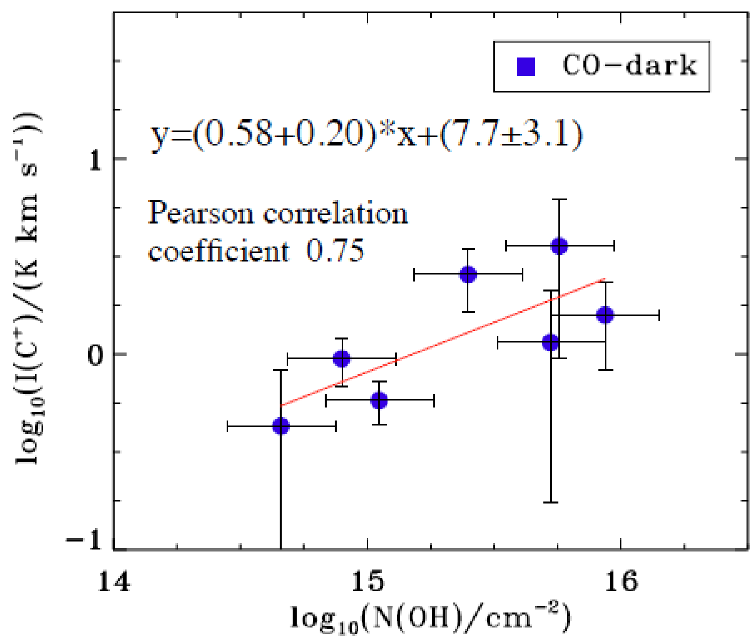
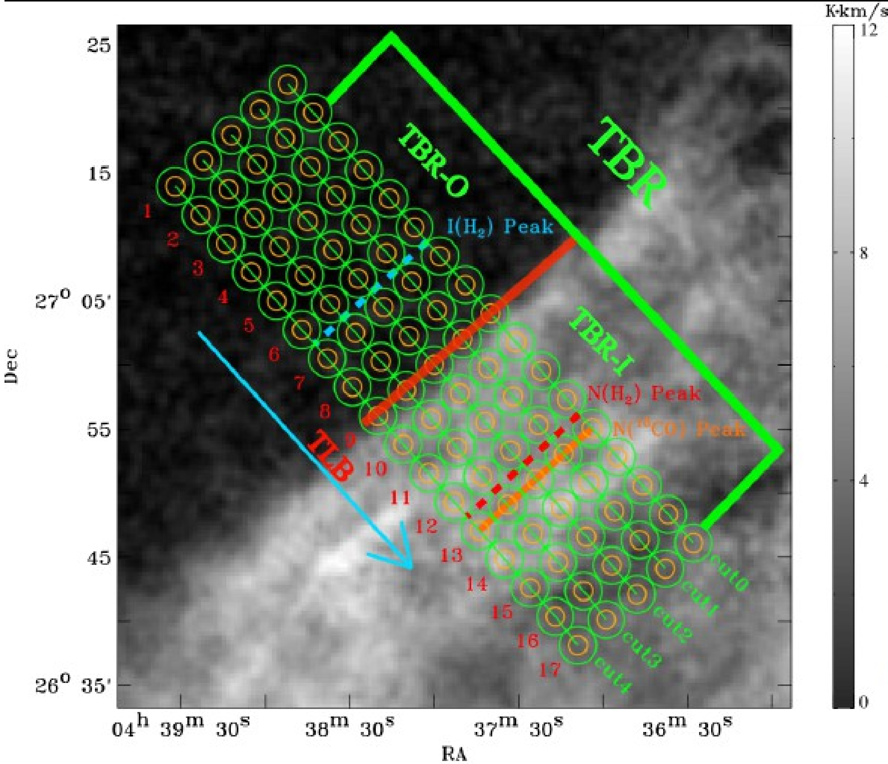


TABLE 1
Summary of detections of all 151 OH clouds.

Mask	OH	C^+	^{12}CO	^{13}CO	Number[a]	HINSA[b]
1	√	x	x	x	17	1
2	√	x	√	x	17	5
3	√	x	√	√	50	24
4	√	√	x	x	10	1
5	√	√	√	x	9	2
6	√	√	√	√	48	16

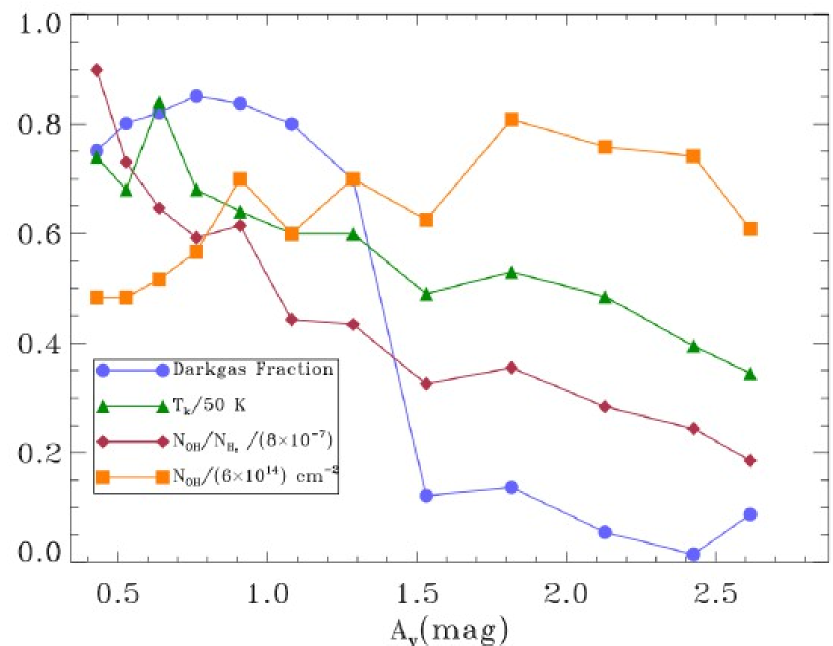
[a] The number of clouds in each mask.
[b] The number of HINSA detection in each mask.

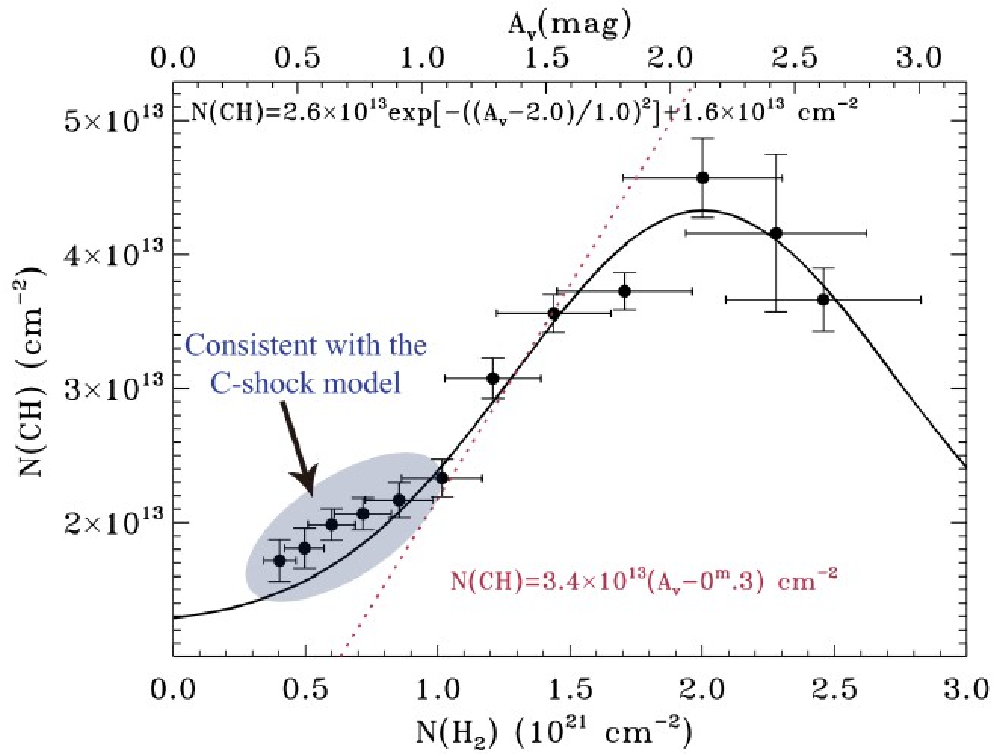
candidates.



- Colliding streams or gas flow at the boundary region
- Modeled OH transitions with RADEX
- Quantifying OH abundance and CO-dark molecular gas
- Conjugate emission of OH 1612 MHz and 1720 MHz indicating C-shock
- Overabundance of CH at A_V<1 mag indicating C-shock
- CH is a better molecular gas tracer than CO and OH in the transition zone (0.8<A_V<2.1 mag)

(Xu et al., 2016)





Thank You!

- To participate in HIFAST survey
  contact: Marko Krčo (marko@nao.cas.cn)
- For OH Observing Proposals
  contact: Marko Krčo (marko@nao.cas.cn) or Di Li (dili@nao.cas.cn)

- OH Survey Along Sightlines of Galactic Observations of THz C+
  Ningyu Tang, et al. (ApJ 2016, submitted)
  astrotomny@gmail.com
- Evolution Of OH and CO-Dark Molecular Gas Fraction Across A Molecular Cloud Boundary in Taurus
  Duo Xu et al. (ApJ 2016)
  xuduo117@163.com

- KEEP AN EYE OUT FOR CONFERENCE ANNOUNCEMENTS!

HELP
WANTED

Opportunities

- East Asia Core center of Astronomy (EACOA) Fellow: \$5000/month; two host during tenure
- National Astronomical Observatories of China (NAOC) Fellowship
- Big Science Center-FAST Fellowship
  - Senior fellowship (2weeks - 1month)
  - Key Staff: ~1year
  - Postdoctoral fellowship: 2-3 years @ 2/year
- Chinese Academy of Sciences (CAS) Fellowship (PIFI etc.)
- Talent program: ~\$400 ~ 500 K startup grant