EVLA Planning Workshop: Defining the Second Phase

Answers from the Scientific Working Group on Extragalactic Spectroscopy: Evolution of Gas in Galaxies

23-25 August 2001

I. The New Mexico Array (A+ Configuration)

A. What are the key science drivers for the NMA?

Absorption Studies:

T_{spin} and conditions of ISM

Resolved kinematics of high-z galaxies (needs low-ν system)

Masers:

NH_3, H_20: Physical conditions/kinematics of star forming regions in nearby galaxies; evolution of the star formation rate.

OH: evolution of the Merger Frequency Rate to $z \sim 1$. Kinematics of inner parsec of mergers/protogalaxies to z $\sim$1 (really wants more collecting area).

B. Should we build the NMA?

C. Within the scope of this project, is the baseline plan of 8 new antennas plus PT/LA about right?

D. What is the required maximum frequency?

For spectral line work, only need to 23 GHz

D2. Would you be willing to trade frequncy coverage for collecting area? (freq. coverage here refers to max. freq., not bandwidth)

We would prefer more collecting area.

E. How important is "stand-alone" NMA operation? I.e., should we ensure good sensitivity & imaging capability (and what is "good") when the NMA is operating independently of the VLA/VLBA?

F. What field-of-view is required for the NMA? (as a function of frequency)

G. Rank the relative importance of:

- getting the NMA done as soon as possible ==¿ using traditional antenna technology (25m dishes)
- developing new technology specifically for the EVLA-II, to increase its capabilities (e.g., to give more collecting area)
- developing new technology related to SKA, even if this is not optimal for the EVLA itself (i.e., think of the EVLA as a working scientific array built on the way to SKA)

II. Integrating the VLBA with the (E)VLA

A. How far should we go in integrating the VLBA with the VLA, as part of EVLA-II?

low-frequency cutoff should be same as EVLA

III. The E Configuration

A. What are the key science drivers for the E configuration?

Mapping the Cosmic Web in Neutral Hydrogen:

Can map to 1×10^{17} cm^{-2} in ∼300 hrs (Δv=10 km/s)

Do it with low-ν prime-focus system to map evolution of large-scale structure (to $z \sim 4$ so down to 300 MHz)

Gaseous HI Extent of Galaxies:

Map full extent to $< 1 \times 10^{18}$ cm^{-2}.

Connection between galaxies and absorption line systems

Recombination lines (15 GHz):

map the kinematics of obscured star forming regions (ULIGs)

provides a **direct** measure of unobscured star formation rate (use to calibrate measures at other wavelengths)

B. Should we build the E configuration?

yes

B2. If we build the E configuration, which approach seems most appropriate:

* 500m max spacing: ∼ 9 new pads, cheap
* 300m max spacing: ∼ 15 new pads, matches configuration sequence
* 200m max spacing: ∼ 27 new pads, as dense as we can get
* other

do it soon and cheap..9 new pads

C. How important is shadowing (i.e., observing low declinations)?

not important

D. What frequency range is required?

300 MHz- 23 GHz

IV. Low Frequency Expansion (300–1000 MHz)

A. What are the key science drivers for low frequencies on the EVLA?

Evolution of HI content of galaxies to z ~0.8

Gas content, kinematics, connection with environment, origin of the large fraction of pec/mrg/irr at $z \sim 0.5$ (40% of population), evolution as a function of environment, evolution of DLyα & connection with galaxies

Cosmic Web (see E-config)

HI Absorption/DLyα (see NMA)

Recommended Priorities:

We **MUST** prototype prime focus system NOW

Simultaneously, a study should be made whether better capabilities can be obtained with another technology (many smaller dishes?) for a similar cost

RFI should be investigated at VLA.

Make NRAO a radio quiet zone

B. Should we provide this improved low frequency (300–1000 MHz) capability?

YES!

C. What frequencies must be covered?

300–1200 GHz

V. Connections to Other Initiatives: how does the EVLA fit in with other major astronomical facilities coming on-line over the next decade(s)?

A. What should be the plan for radio astronomy in the next several decades, and how does the EVLA fit into that plan?

B. How should the EVLA relate to LOFAR?

C. How should the EVLA relate to the SKA?

We do not have a compelling science interest in building the NMA, but we do have an interest in how the NMA is built in the sense that development of SKA technologies is likely to benefit our science in the longer term. Therefore we recommend an innovative approach to designing antennas