

Charge to discussion groups

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Evolution of Galaxies through the HI Window
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Astro2010:

The Need for a US HI strategy

- HI science is undergoing a renaissance driven both by **science** and by **technology**
 - **Science**
 - EOR/dark ages exploration
 - Importance of gas to galaxy evolution
 - Kinematic tracer of interactions
 - Distinct probe of cosmology
 - Tracer of dark matter
 - **Technology**
 - "Cameras": Feed arrays => phased arrays
 - New antennas/dish designs
 - Broadband, low noise receivers
 - Flexible, multibit digital spectrometers
 - Processing capability

Our challenge during this conference

- Let us discuss the science that HI studies across cosmic time can **drive**
- Let's dream a long term vision: **SKA**
- Let's articulate a shorter term roadmap that:
 - Leads towards our long term vision => ***dream!***
 - Achieves exciting and critical science results along the way => ***maintain vitality!***
 - Articulates the path in a realistic and inclusive manner => ***be real!***
 - We can't have it all (***right away***)
 - We won't have it all (***right away***)
 - We all need to be involved (***now***)

Discussion groups (over wine/piña coladas)

Discussion Groups: one approach

- Is Leo right?
- Is Gerhard right?
- Is Liese right?
- Is Oleg right?
- Is Steve right?
- Is John right?
- Maybe not the best organization.....

Our challenge during this conference

Hypotheses:

- Dark Ages/ EOR experiments will proceed
 - RSST/SKA will be built > 2020
1. What are the principle questions for which HI science provides **CRITICAL** clues could be answered in the next ≤ 10 years?
 - What do those of you who aren't HI observers need from us?
 - What do we need from you?
 2. What are the observational/technical specs required to achieve them? (**Reality check**)

Science Discussion groups

- Dark ages science/EOR ($z > 6$)
- High redshift galaxies ($z > 0.5$)
- Intermediate redshifts (0.25 -0.5)
- Cosmic web, local DLAs
- HI mass function
- HI \leftrightarrow SF connection
- DM Halo \leftrightarrow galaxy connection
- Near-near field: Milky Way/Local Group

US Strategy

- **Dark Ages/EOR**

- Several experiments using somewhat different approaches underway
- Technical issues associated with RFI and foregrounds recognized and proceeding
- 2nd generation experiments should follow these
- Is this program on track?
- THEORY/SIMULATIONS => Further work needed? What don't you (really) know??!

WHAT CAN HI DO FOR YOU?

US Strategy

- How do galaxies accrete their gas?
 - Is Leo right?
 - What are the/all HVCs?
 - Does the total cold gas vary as $fn(T, L, z...)$?
 - How well does HI map the total gas?
 - Where do the metals in DLAs come from?
 - Where do blue sequence E/SO's get their gas?
 - How do DM halos map to real galaxies?
 - Are the simulations correct? Open questions?

WHAT CAN HI DO FOR YOU?

US Strategy

- Normal galaxies

- How do baryonic components (HI, H₂, stars) compare to dynamical mass as $f(L, \text{SFR}, \text{environment})$ over cosmic time?
- Where is the HI in blue cloud galaxies?
- Why are some HI disks very extended?
- How does evolution in HI relate to evolution in SFR? Is HI the smoke or the gun?
- Cold vs hot gas accretion around AGN

WHAT CAN HI DO FOR YOU?

US Strategy

- Dwarf galaxies

- Where is/are the gas/galaxies in voids? Is there a "void problem"?
- Are their gas-rich "missing satellites"?:
 - Are there "starless" dwarfs?
- What drives variation in SFH?
- What is duty-cycle for SB dwarfs?
- How many dwarfs are there?
- How many? 100, 1000, 10000...

WHAT CAN HI DO FOR YOU?

US Strategy

- **HI in interactions**

- Do interactions drive the evolution of the SFR density?
- In major mergers, what happens to the gas?
- What triggers/regulates SF in normal disks?
- What can HI teach us about evolution in clusters?
- How many dwarfs are formed in interactions?
- What is the impact of feedback?

WHAT CAN HI DO FOR YOU?

US Strategy

- HIMF/evolution

- Why does ALFALFA detect so many galaxies?
- Is there a universal HIMF?
- Is there a primordial HIMF?
- How does $\text{HIMF}/\Omega_{\text{HI}}$ evolve with z ?
- What do simulations predict about HIMF (not just "cold gas")?

WHAT CAN HI DO FOR YOU?

US Strategy

- + Anything else : this is your chance to make a case for what we need to do!

WHAT CAN HI DO FOR YOU?

Should we use current facilities in new ways to build towards RSST/SKA?



US Strategy

- EVLA surveys: Blind? Deep? Commensal?
- Next generation Arecibo surveys
- GBT?
- ATA
- Low frequency experiments
- Collaborations/participation in/with international projects
- Critical theory/simulation challenges
- Technology development
- Direct collaboration with surveys/projects at other wavelengths
- Infrastructure issues: education/training/support