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Looking for low column density gas with MeerKAT & FAST
用MeerKAT和FAST寻找低密度气体

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The SKA precursor MeerKAT was inaugurated on July 13 and will start 10 Large Survey Programmes at the end of 2018. FAST has started its observations in "drift scan" mode with CRAFTS (Commensal Radio Astronomy Fast Survey). In the near future (2019-20), the best combination to study low column density HI will be to combine the sensitivity of FAST with the spatial resolution of MeerKAT. The combination of the data from those two telescopes will allow, 4-5 years before SKA1-MID, to do "cosmic web" research to levels < 5 X 10^{17} cm^{-2}, close to 10^{16} cm^{-2}, densities that would normally only be accessible to the full SKA around 2030. It is at those densities that we expect the galaxies to connect with the surrounding cosmic web.

The South African SKA-mid precursor MeerKAT

- How do galaxies accrete the gas necessary to sustain the observed SFRs, which are much higher than expected from the gas observed in galaxies (~1-2 Gyr gas consumption timescale).
- Even the expected contribution from minor mergers and left-over gas in the halos of galaxies fall one order of magnitude lower than what is needed (e.g. Sancisi et al. 2008).
- Thus gas **must be accreted** from the Inter-Galactic Medium (IGM)
- The two questions are:
  1. At which column density level ?
  2. On what scales ?

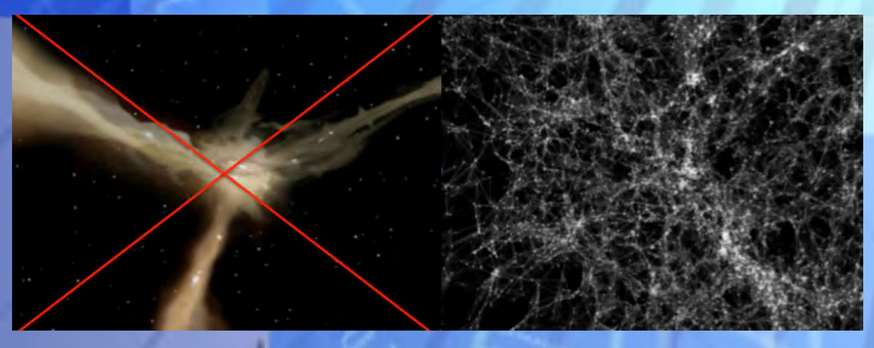

Fig.1: the Cosmic Web is expected to be in discrete small scale clouds and not in large scale filaments (e.g. Wolfe at al. 2013; between M31 & M33).

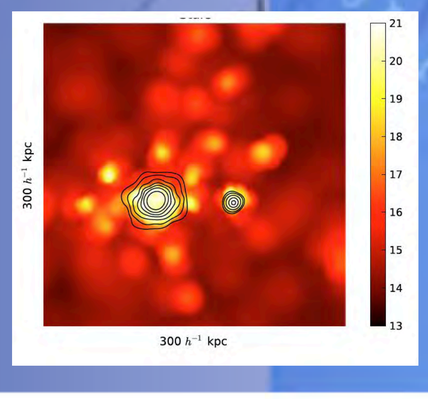

Fig.2: Simulation of the morphology of the low column density material (Popping at al. 2009). The material is expected to be clumpy and at column densities ~ 10^{16} cm^{-2}. Contours indicate the locations of the stellar components.

The Chinese largest (500 m) single-dish FAST

Need high spatial resolution and high sensitivity to detect the cosmic web gas

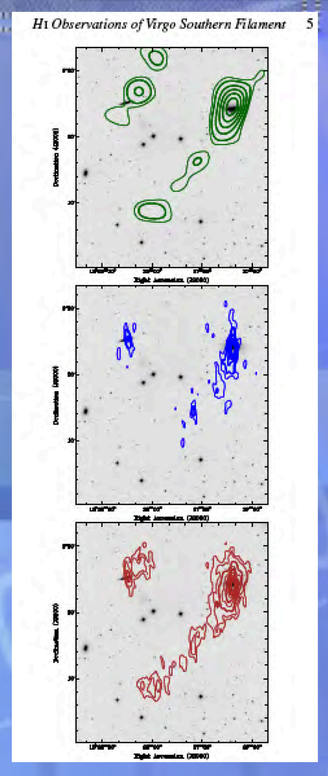

Fig.3: combination in the map plane (bottom) of low spatial resolution but high sensitivity KAT-7 data (top) with high resolution WSRT data (middle).
(Sorgho at al. 2017)

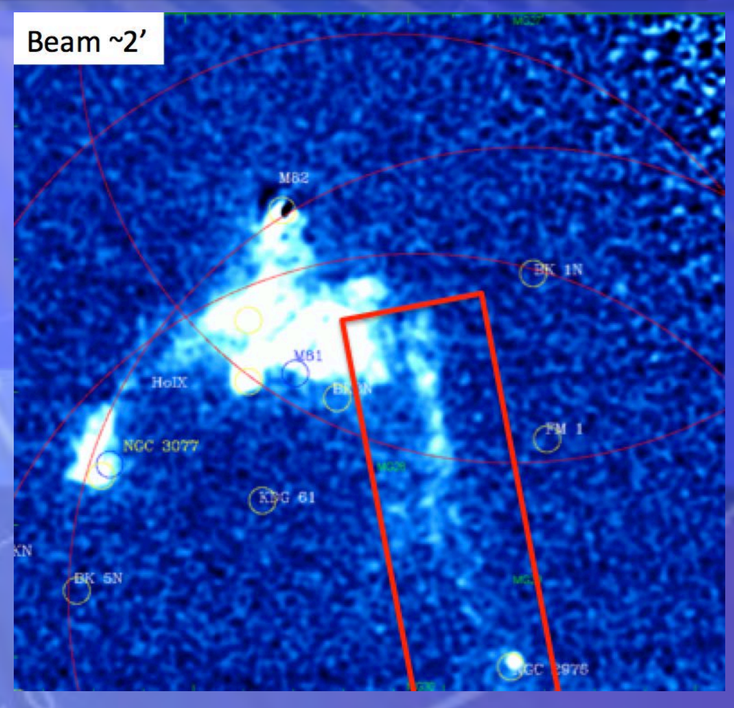

Fig.4: DRAO HI observations of the M81/M82/NGC3077/NGC2976 group. The clouds are detected below ~ 10^{18} cm^{-2} on small scales (A. Sorgho's thesis).

Conclusion: *FAST* will allow us to get to the ~ 10^{17} cm^{-2} regime and *MeerKAT* will give us a spatial resolution ~ 5-30", both necessary to detect the Cosmic Web gas.