Continuum surveys with the SKA

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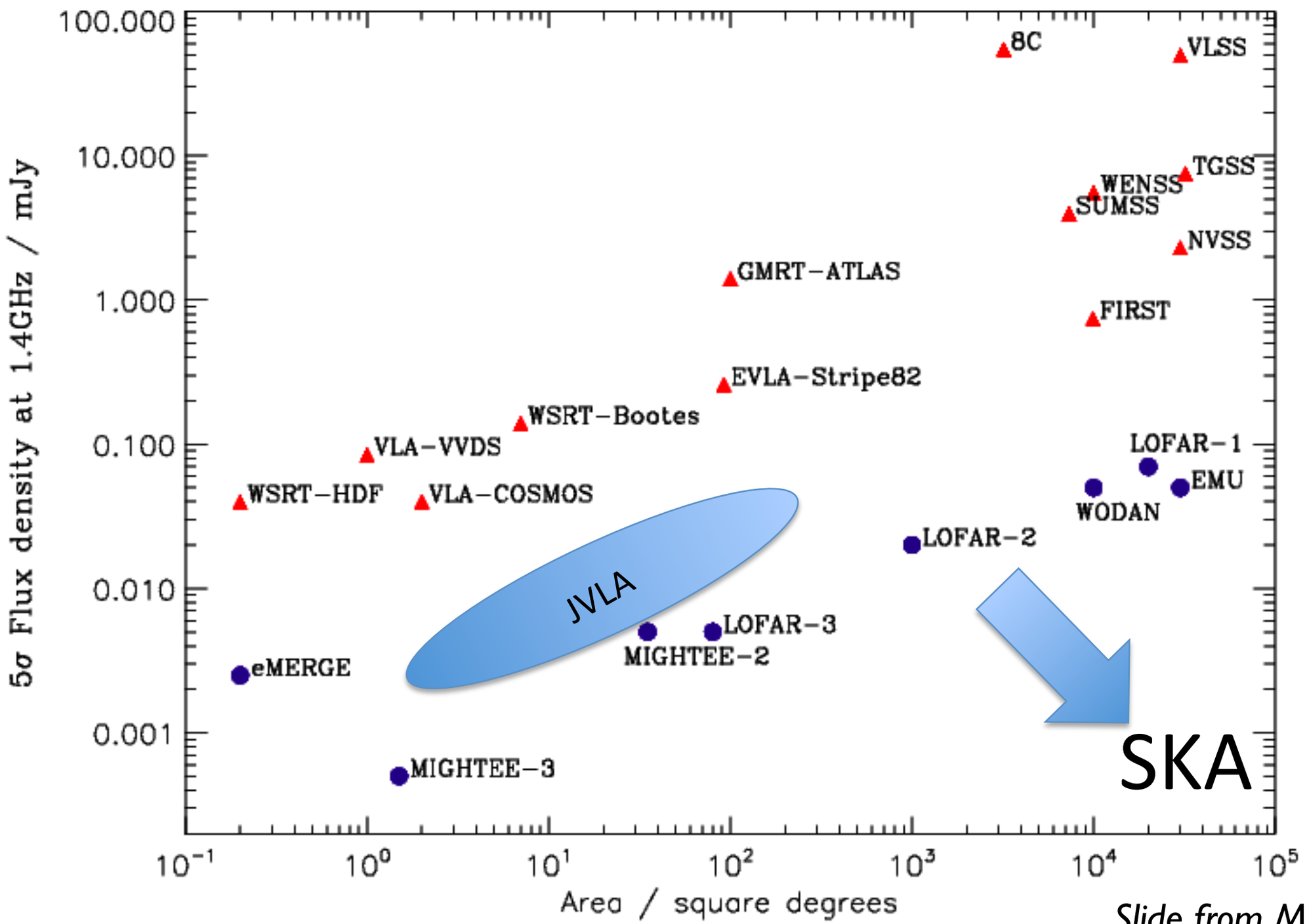
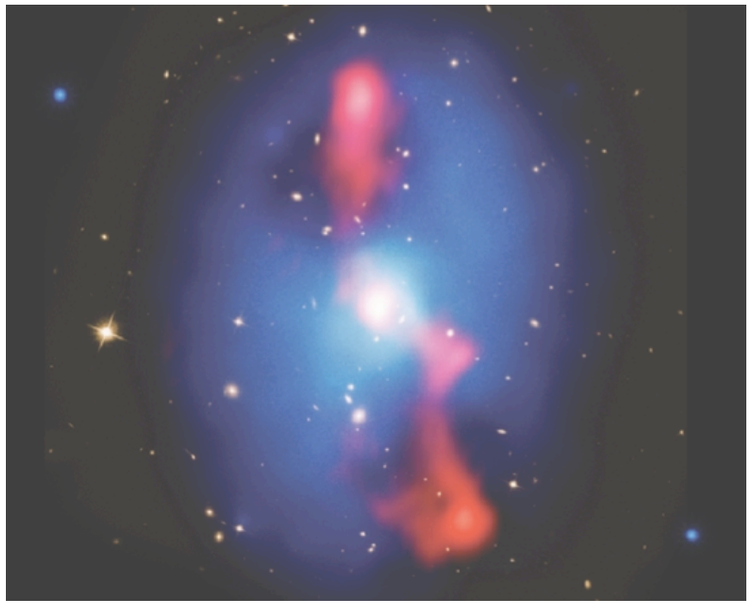
The new radio continuum surveys



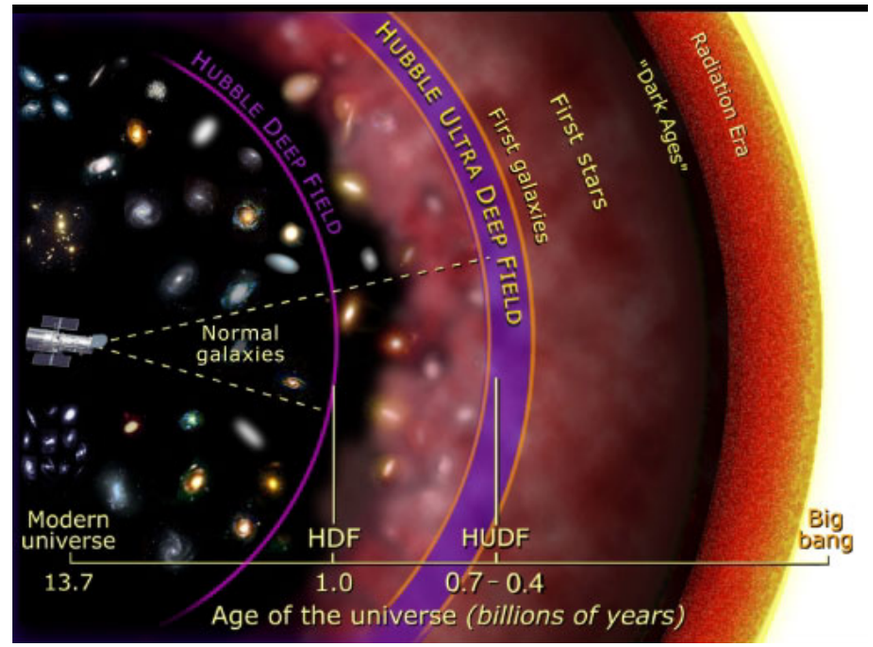
Slide from Matt Jarvis

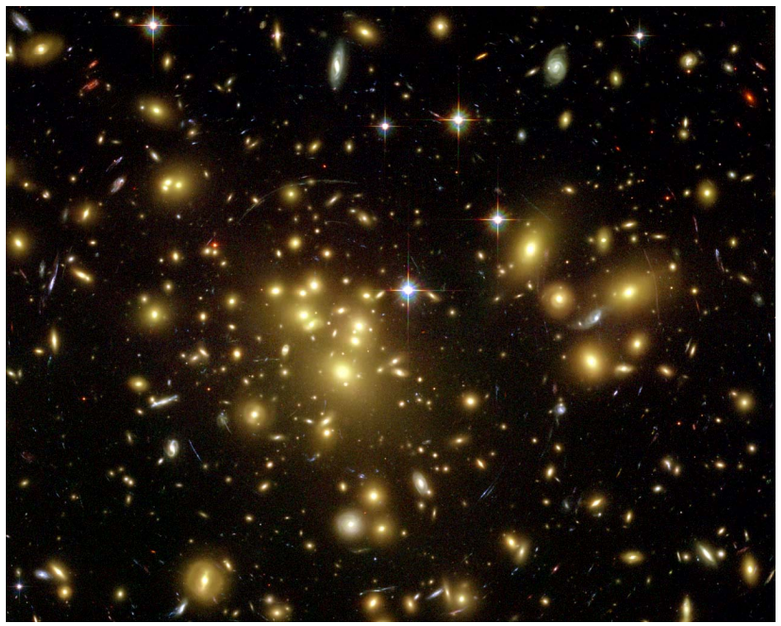
Galaxy Formation and Evolution with the SKA

How does accretion onto black holes affect the evolution of galaxies?



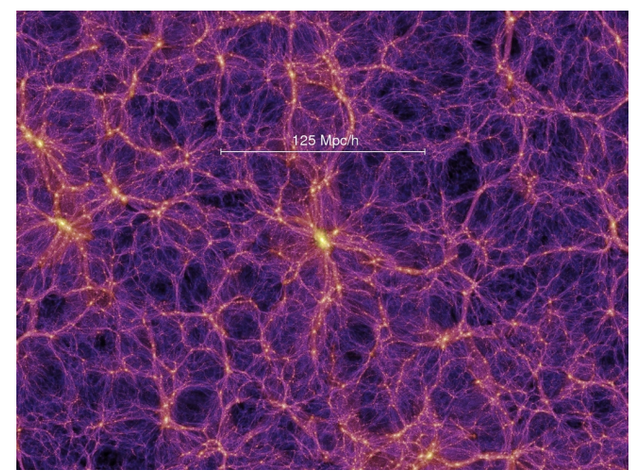
How and when were the first galaxies formed?



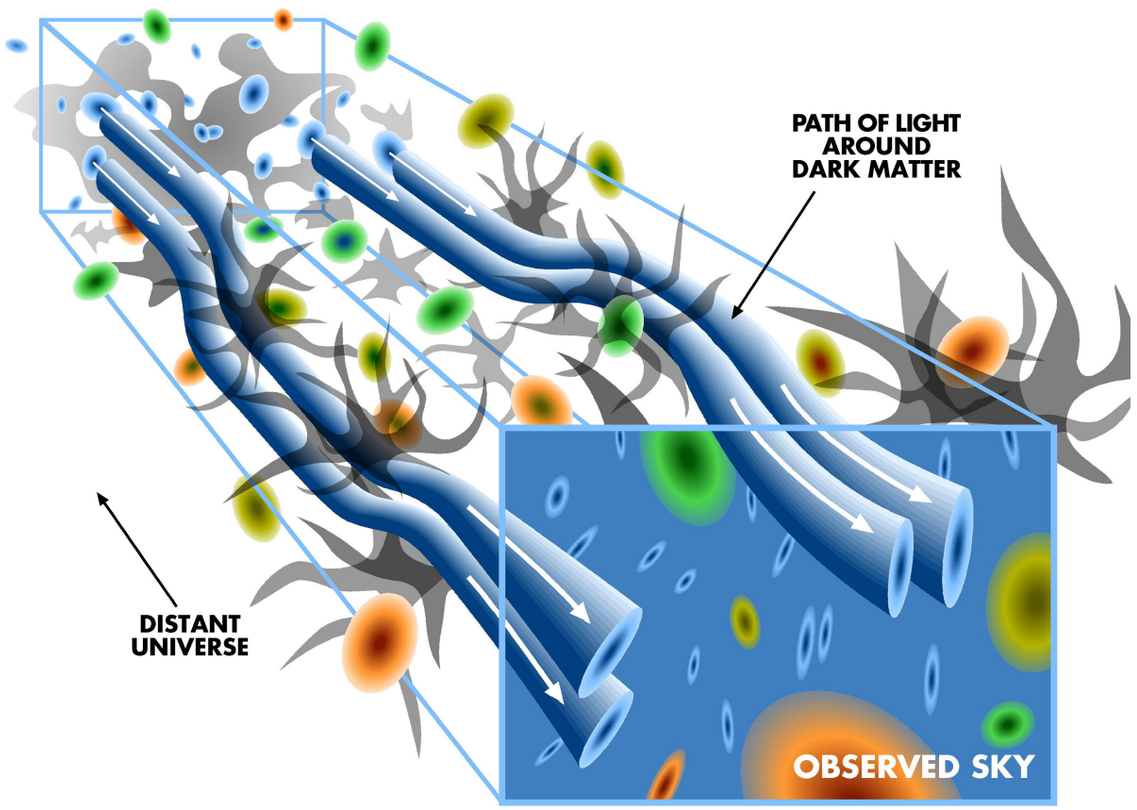


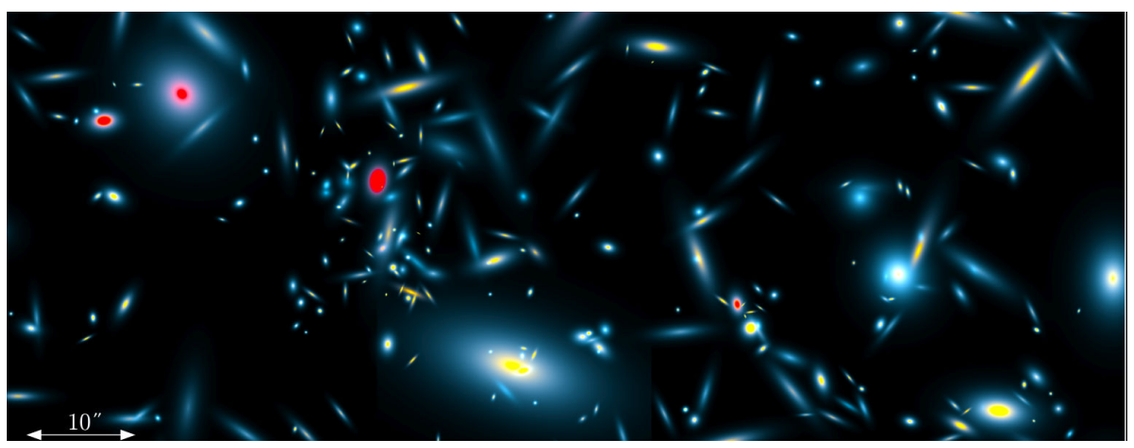
What is the environmental influence?

How do Baryons trace and affect the Dark Matter distribution?



Cosmology and Continuum Surveys





- Light paths affected by gravity
- Gravitational potential affected by matter
  - … both luminous and dark matter
- Results
  - ➢ 2.1 Weak lensing
  - ➢ 2.2 Cosmic magnification
  - ➢ 2.3 Integrated Sachs-Wolfe (ISW) effect

Exploring the Universe with the world's largest radio telescope

Slide from John Conway

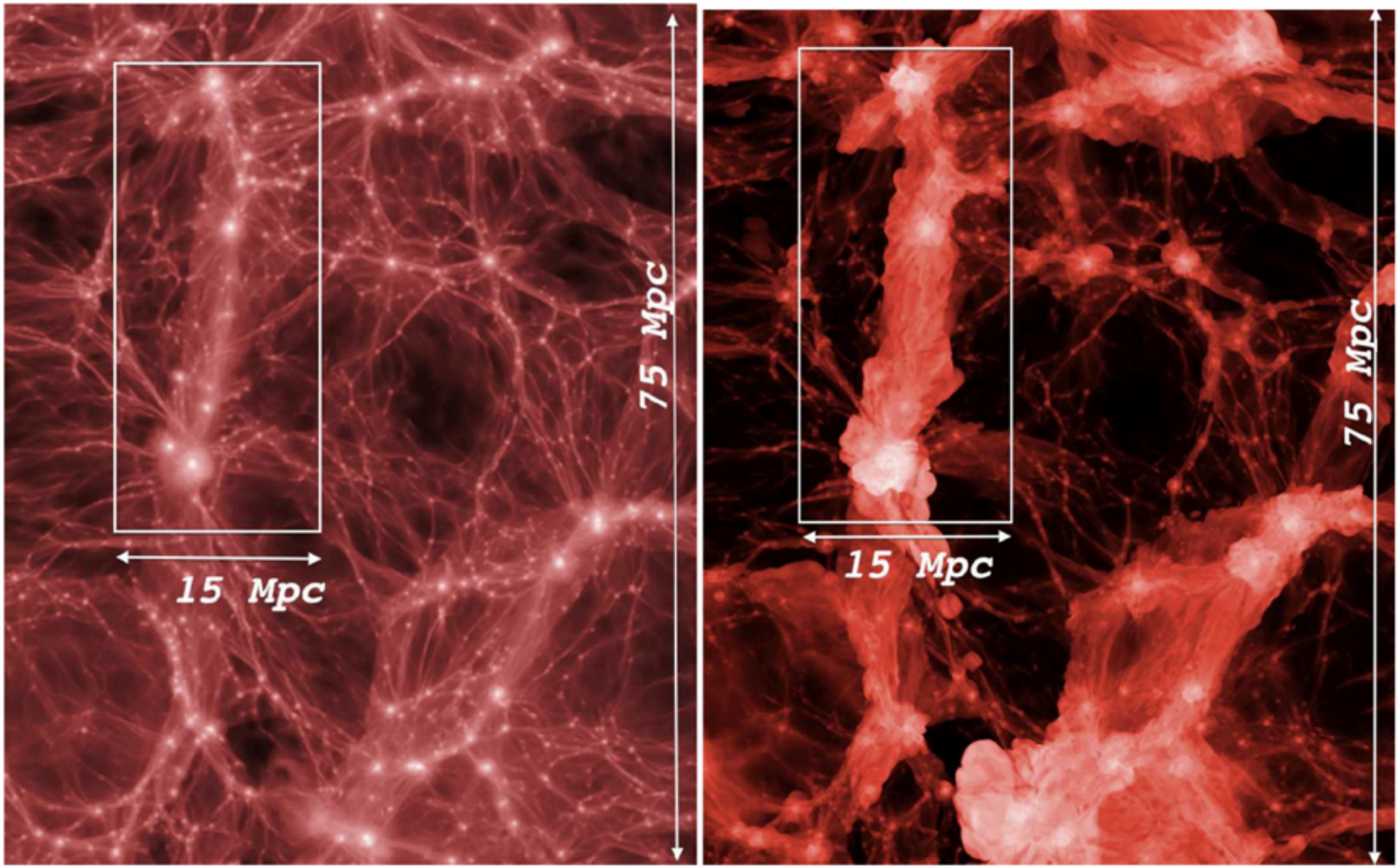


Figure 1. Projected gas density (left) and gas temperature (right) for a (75 × 60Mpc) volume simulated with *ENZO*, with a uniform resolution of 54kpc/h. The color coding shows $\log_{10}(\mathrm{rho}/\mathrm{rho_m})$ and $\log_{10}(\mathrm{T[K]})$. The white rectangular region displays the region considered for our analysis.

Simulations by Franco Vazza

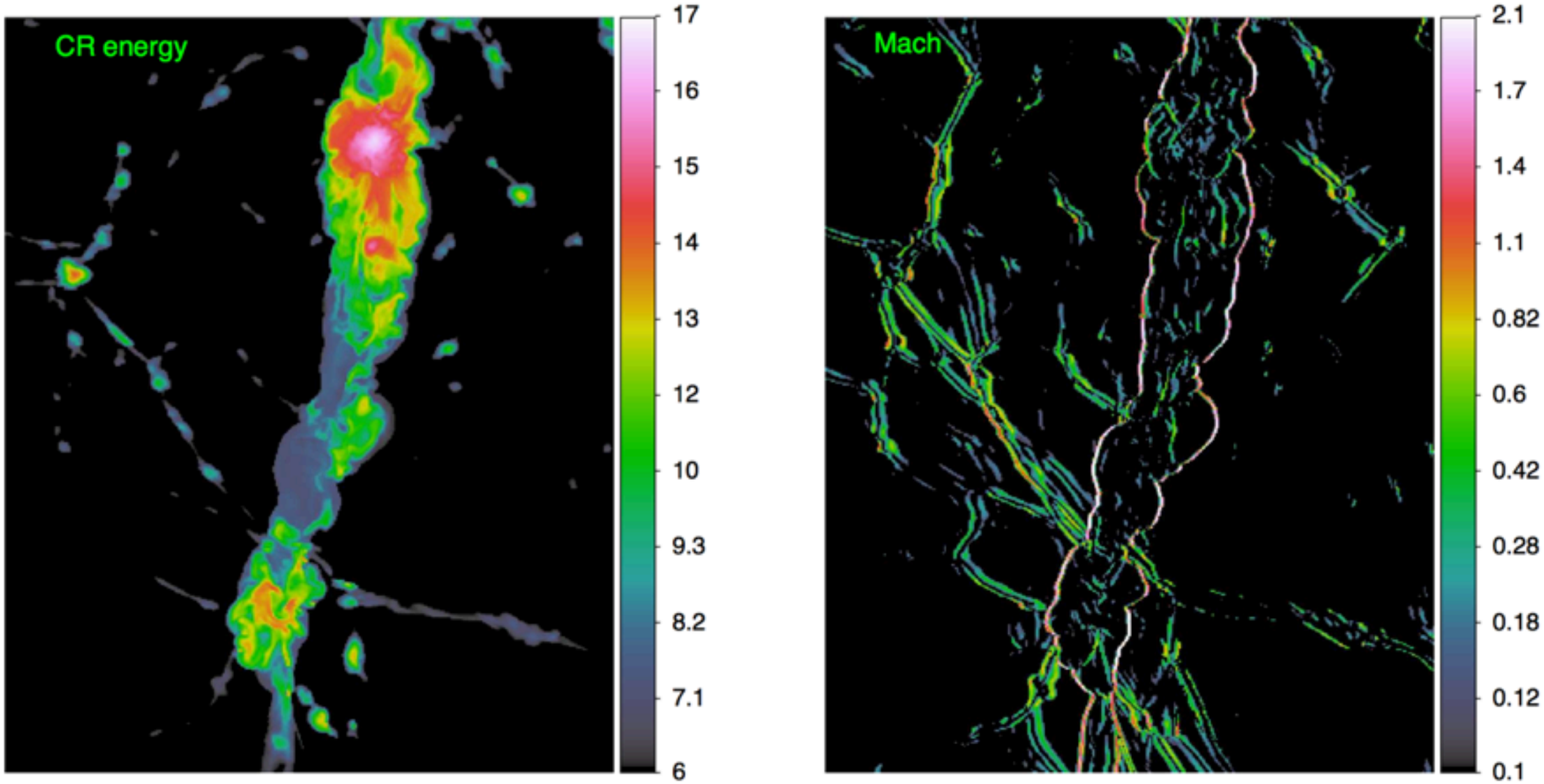


Figure 2. Left: slice through the middle of the filament, showing the energy in CRs at $z = 0$ ($log_{10} E_{\rm CR}$ (for the Kang & Jones (2007) model, arbitrary units) Right: distribution of shocks Mach number for the same slice (in $log_{10} M$). The thickness of the slice is 1 cell, 54kpc/h.

Simulations by Franco Vazza

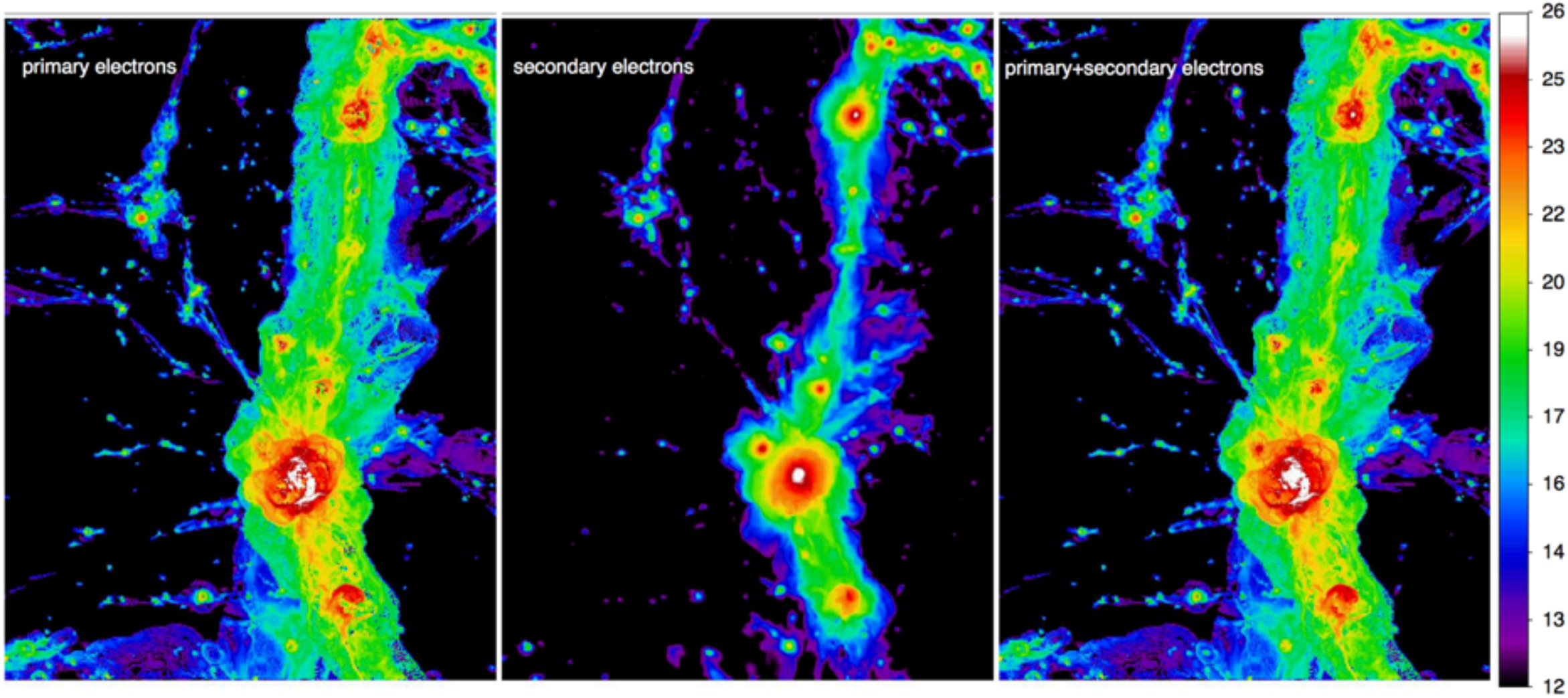


Figure 4. From left to right: radio emission from primary electrons, secondary electrons and total radio emission for the Kang & Jones (2007) acceleration model and assuming equipartition magnetic field. The color coding shows $\log_{10} \mathrm{P}_{\mathrm{radio}}$ $[W/Hz]$.

Simulations by Franco Vazza

Science assessment workshop

SKA Office on 2013 September 9-11

SKA-LOW Tiger Team

Example Surveys:

(1) Deep (galaxy evolution): A 30 deg^2 survey with 0.5" resolution (for resolved morphology of galaxies) and T~0.1K rms =~ 40nJy/beam (for galaxy evolution at z>1) – deep fields and lensing clusters. Note that a less sensitive survey can be weighted differently to provide either 0.5" resolution or T~0.1K depending on the science goals.

(2) Wide (weak lensing): A 5,000 deg^2 survey with 0.5" resolution to detect at least 5 sources per arcminute squared (for cosmological weak lensing, galaxy evolution z<1). This approximately corresponds to 0.34 μJy/beam at ~1GHz, but there is a trade-off between frequency/depth/resolution for the source density requirement.

(3) All-sky (legacy/Local Universe): A ~1-2GHz image 31,000 $deg^2/3\pi$ steradians with 2" resolution and 2μJy rms/beam (thus satisfying the confusion and temperature brightness (for power spectrum, legacy, cluster/diffuse, magnetism, galactic science, local Universe).

Key outcome:

• currently proposed configurations for the mid frequency elements do not provide the sensitivity at high resolution required to conduct the Deep and Wide surveys in a reasonable time.

• The down-weighting of the short baselines leads to survey times of decades, rather than months/years as would be expected of a general user facility.

• The All-sky survey, on the other hand, could be feasible with SUR in 2 years timescale.

Other issues:

dynamic range

frequency coverage

Thank you.