

LOFAR MSSS

Multifrequency Snapshot Sky Survey

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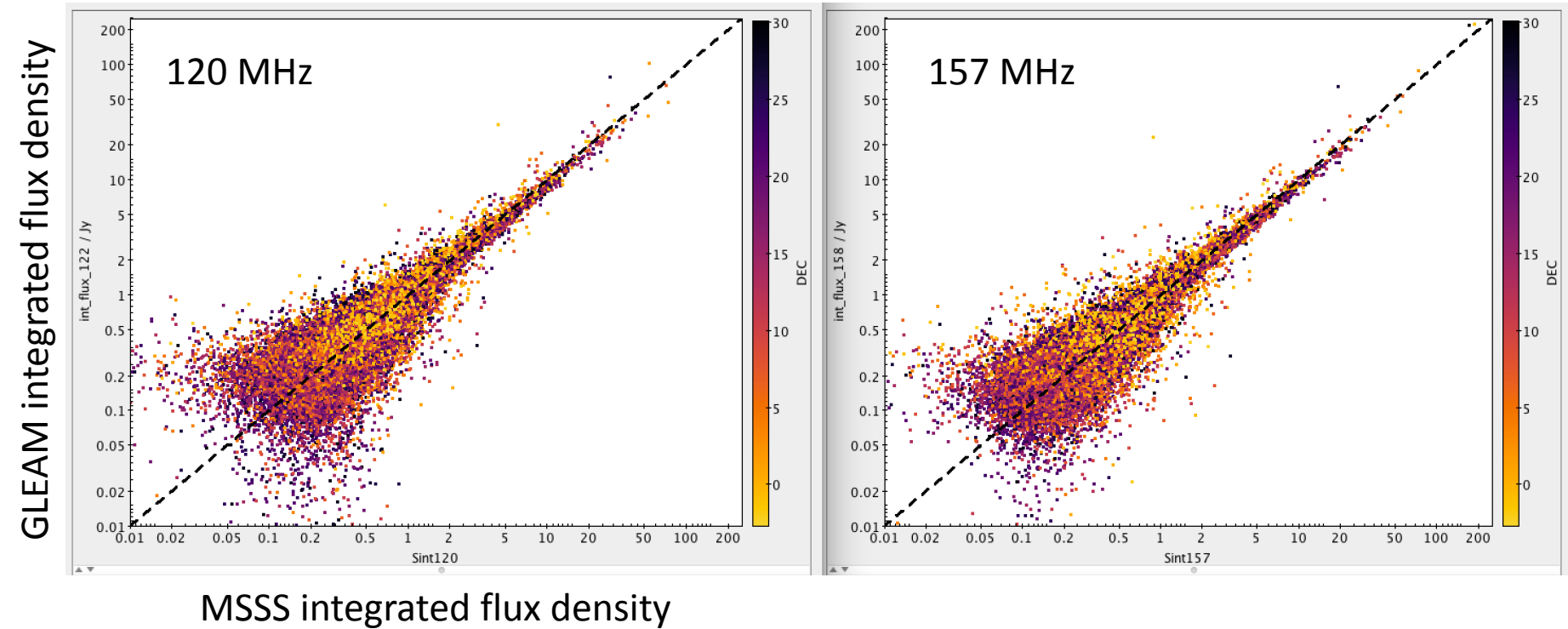


Current status and plans

- HBA: low resolution imaging at $\sim 2'$ complete
 - Entire northern hemisphere, except for exclusion zones around CasA and CygA
 - Internal catalog (v0.3) available to team, with 138,342 sources
 - Currently addressing some inconsistencies in image parameters across survey area

MSSS flux scale

- New flux scale technique (Hardcastle+ 2016) applied and verified
 - In-band (120-160 MHz) fluxes now considered reliable



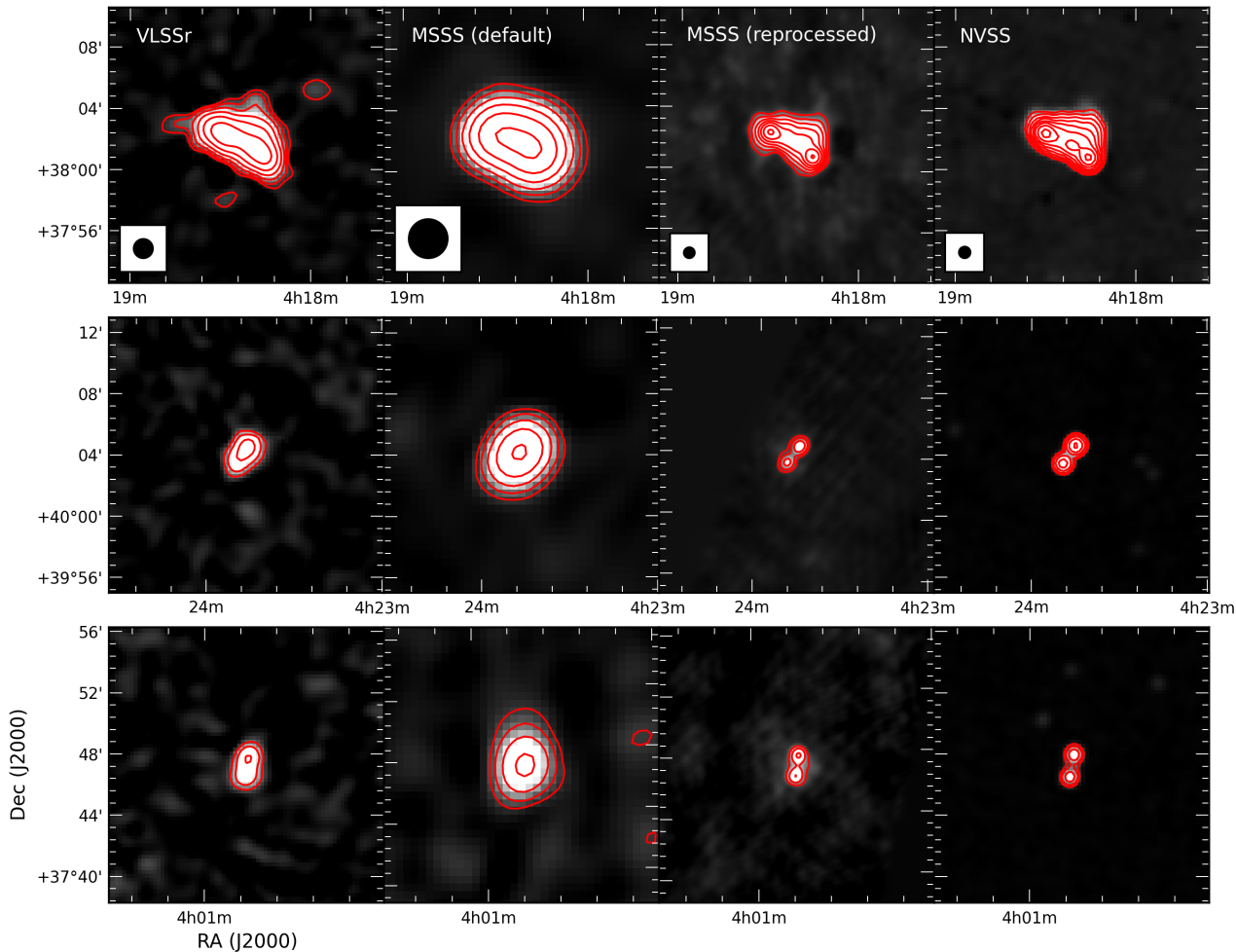
- Reliability of flux scale across MSSS frequency coverage checked through cross-matching with GLEAM (Hurley-Walker+ 2016)

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 - Internal catalog (v0.3) available to team, with 138,342 sources
 - Currently addressing some inconsistencies in image parameters across survey area
- Potential for higher resolution products along with availability of other high-quality surveys (GLEAM, TGSS ADR1) now motivating updated parameters for MSSS data release

MSSS at higher resolution

- All Dutch station baselines included in MSSS-HBA observations
- Imaging at 30-45'' resolution feasible with modest computing



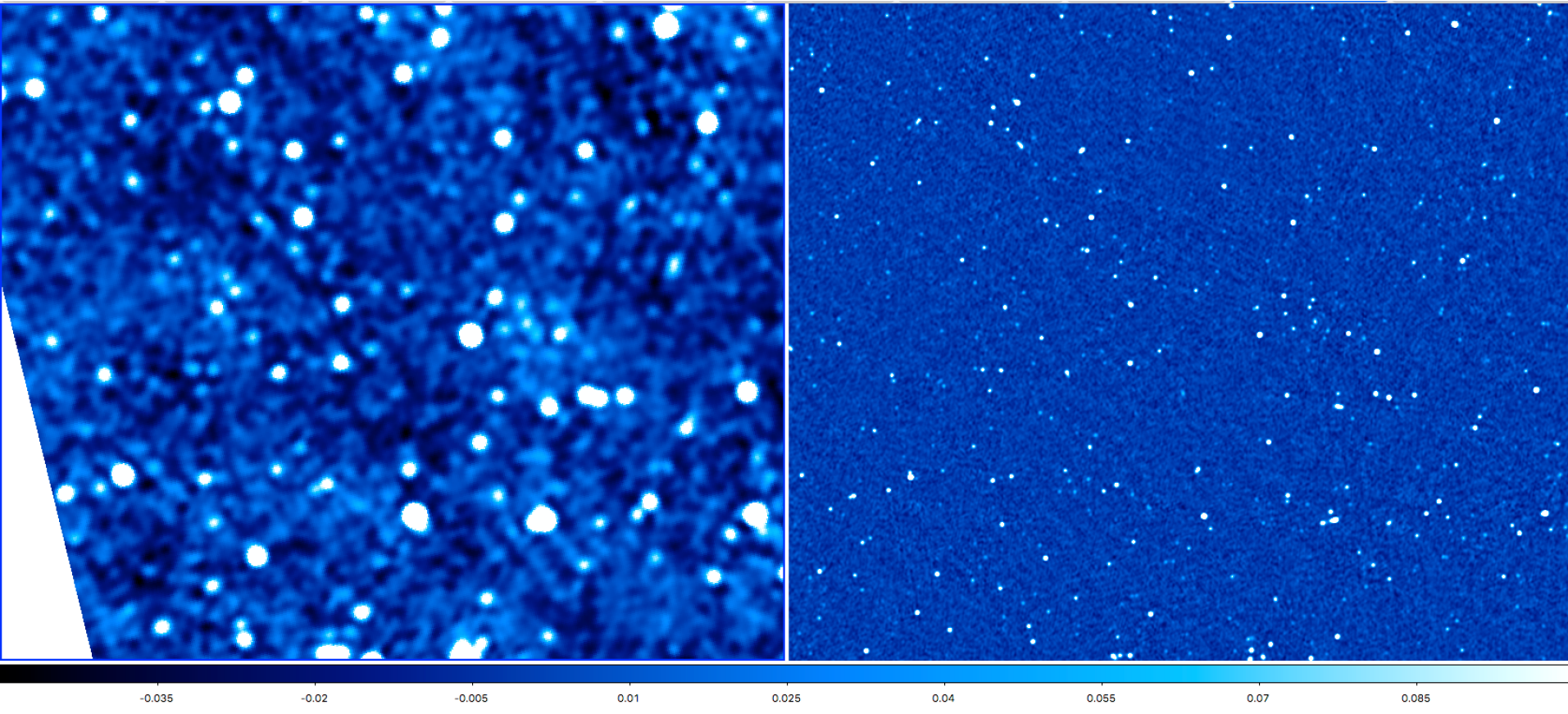
Heald et al 2015

Example field

• MSSS (left)

and

NVSS (right)

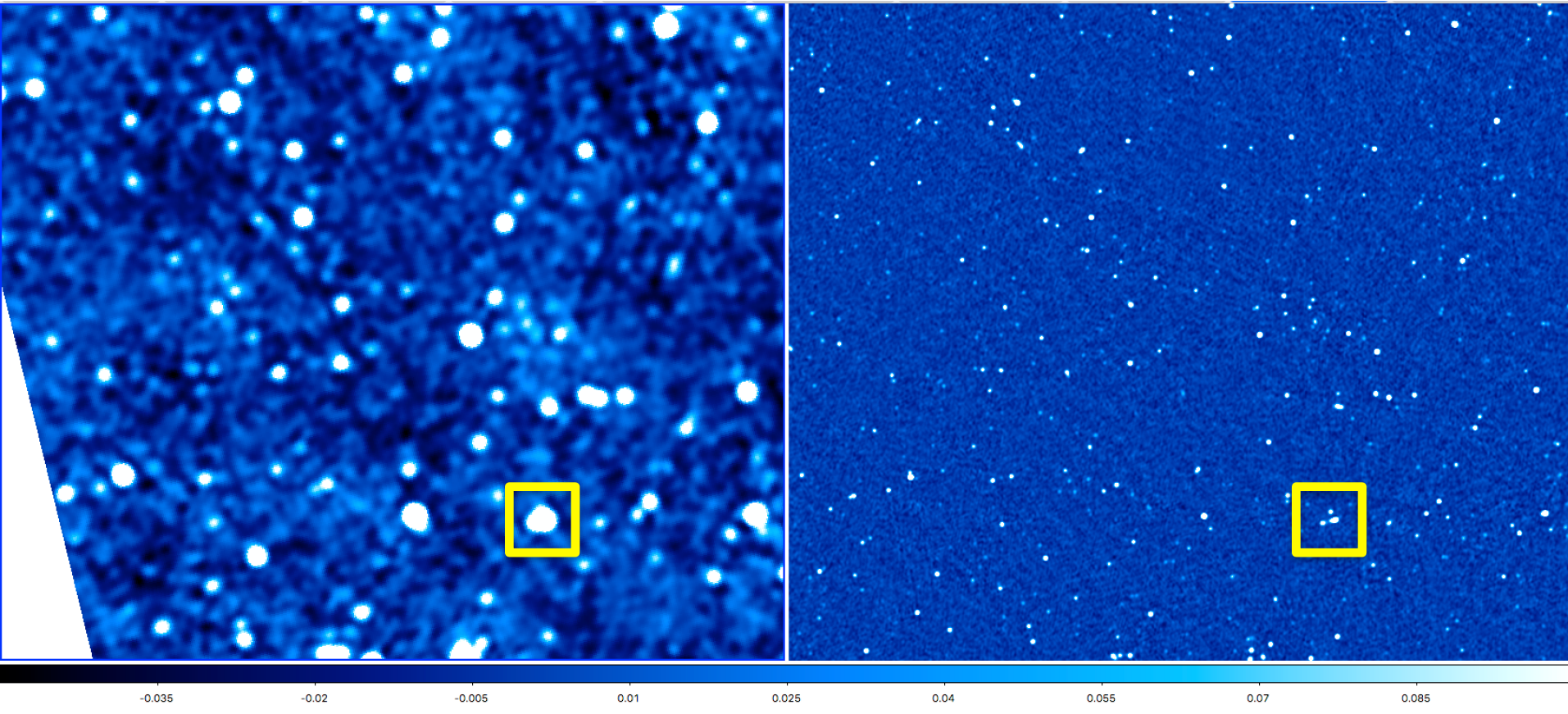


Example field

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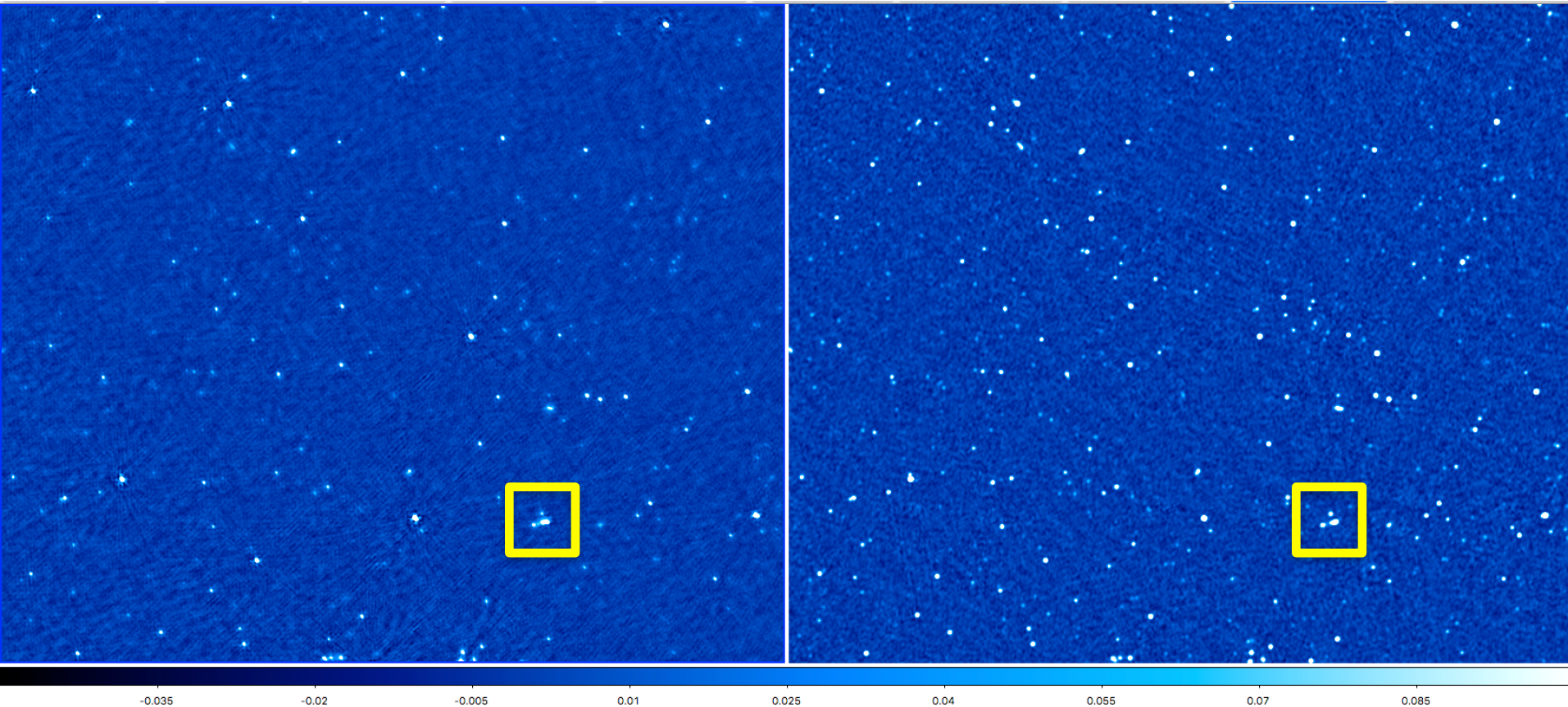


Example field

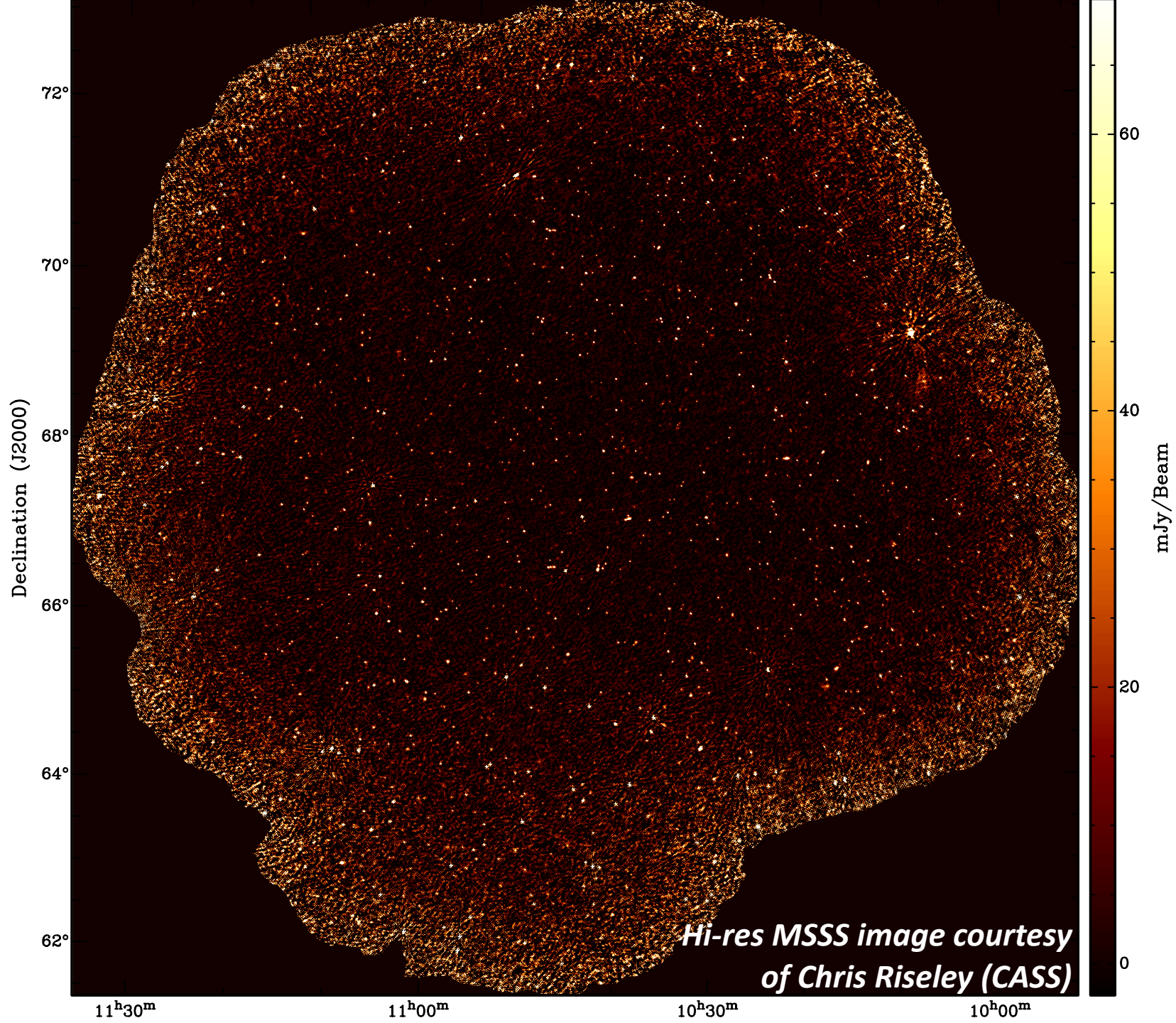
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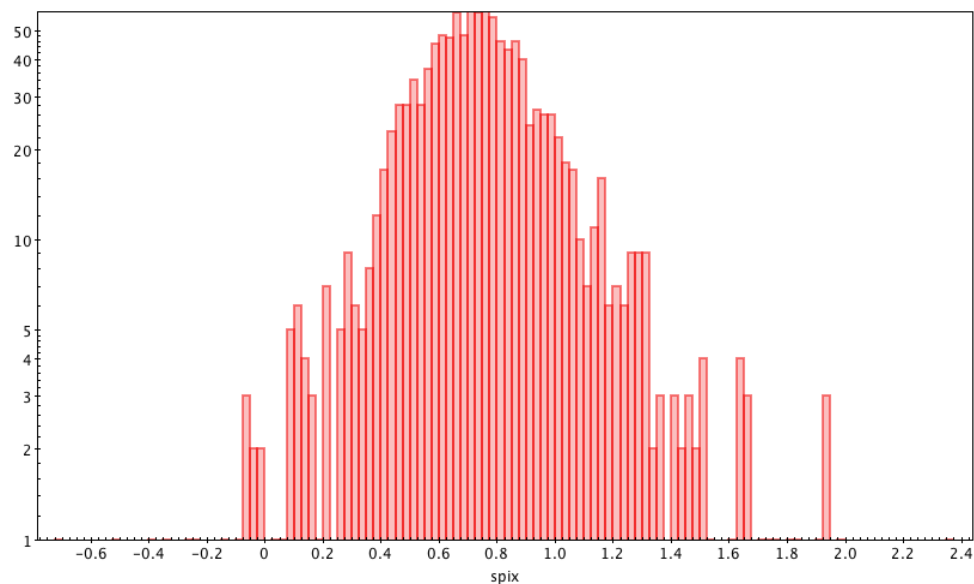
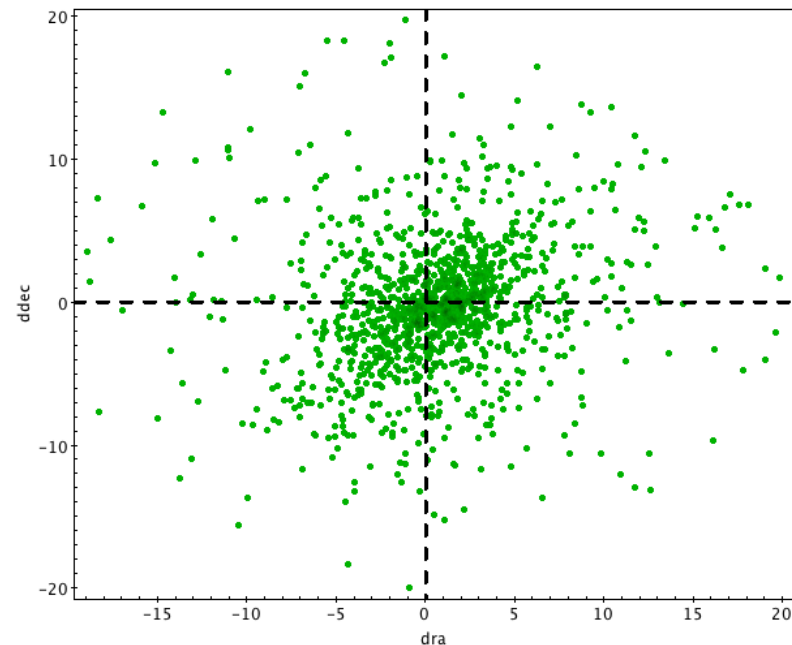


High-resolution MSSS image courtesy of Chris Riseley (CASS)



MSSS image quality

- Current testing & results:
 - wsclean with full-band deconvolution
 - at 45", 3-5 mJy/beam limited by ionospheric artifacts
 - mosaicking with bespoke script (pyrap.images)
 - ~1" astrometric accuracy (based on ~1200 sources cross-matched with NVSS)
 - Updated assessments of CLEAN bias & completeness to be completed soon

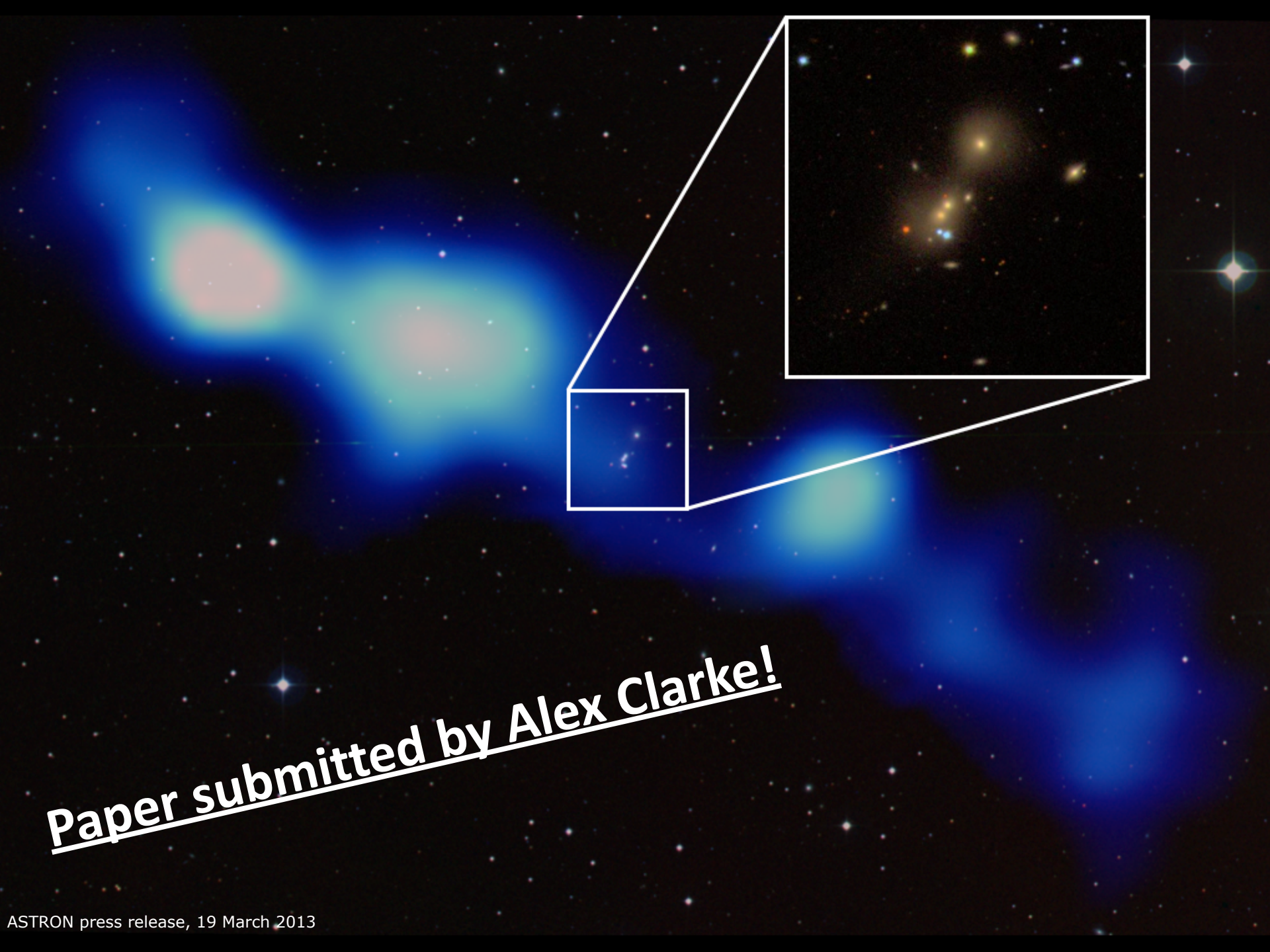


Science from MSSS

Planning and call for action

MSSS science projects

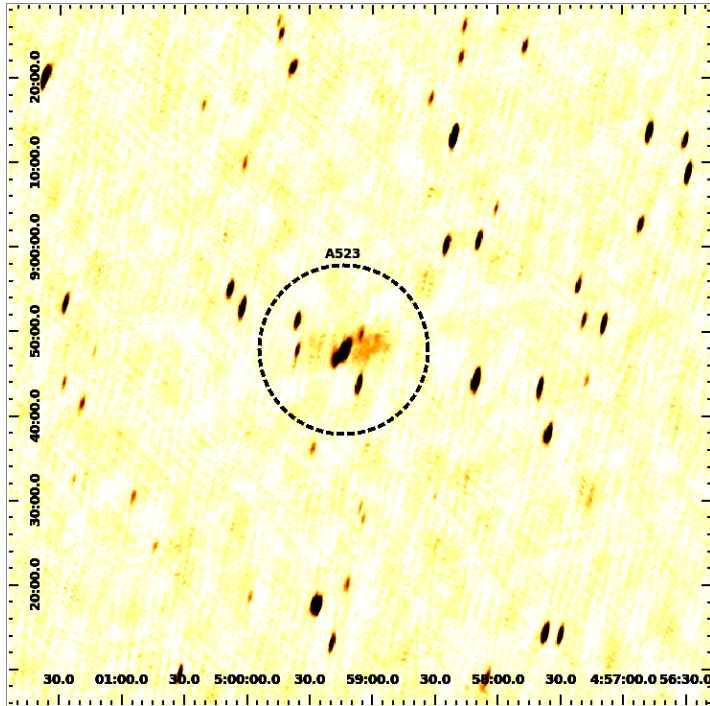
- Planning underway for 33 science projects, many focused on high resolution images / catalog
- Examples (**see the LOFAR wiki**):
 - Gravitational lenses
 - HII regions
 - Galaxy SEDs
 - Cluster halos
 - Pulsars
 - Transients
 - GRGs
 - ... your project here? ...
- Papers submitted and ready to be submitted resp. by Alex Clarke (GRG) and Georgi Kokotanekov (AGN feedback at low frequencies)



Paper submitted by Alex Clarke!

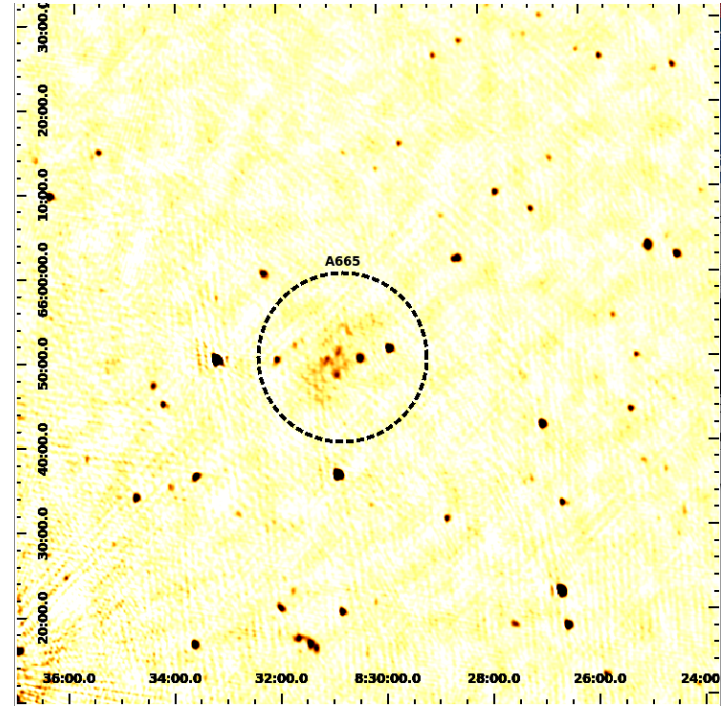
MSSS reimagining for cluster halo detections

- Two examples: A523 and A665



A523

87"x25", $\sigma = 3$ mJy/beam
emission detected at 4.5σ



A665

36"x30", $\sigma = 3$ mJy/beam
emission detected at 3.5σ

Images courtesy Marco Iacobelli & Manu Orru

MAPS: MSSS All-sky Polarisation Survey

- Further processing MSSS data to obtain polarised sky survey
 - high angular resolution —> avoid beam depolarisation
 - superb Faraday depth resolution —> accurate Faraday depth measurements
 - good inner uv coverage —> sensitive to Galactic foreground

*Mulcahy, Farnes, Heald, Horneffer and
MSSS team in collaboration with the MKSP*

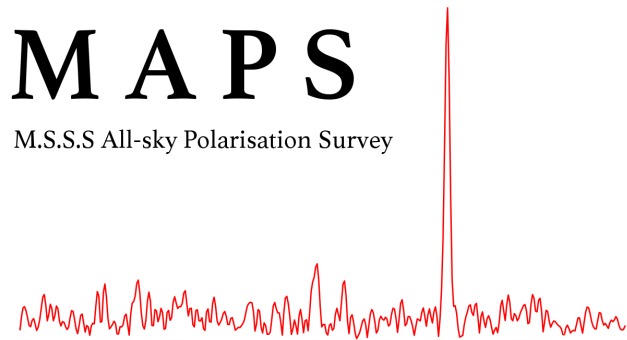
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 - superb Faraday depth resolution —> accurate Faraday depth measurements
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- Many interesting science topics can be explored
 - Search for low frequency polarisation calibrators
 - Depolarisation of radio galaxies
 - Search for pulsars and brown dwarfs
 - studies of the local galactic foreground
 - ... and many more

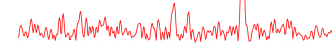
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MAPS

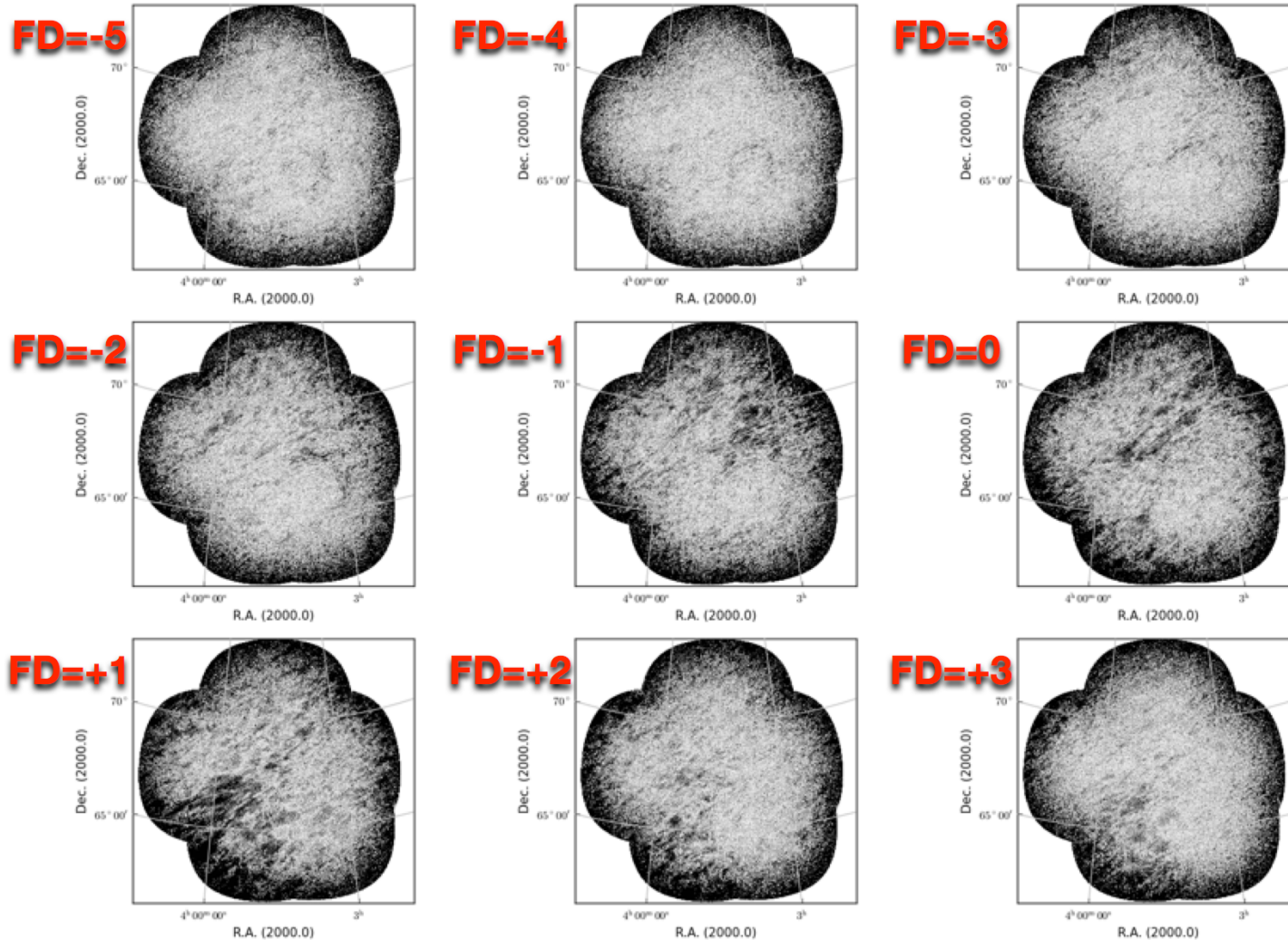
M.S.S.S All-sky Polarisation Survey



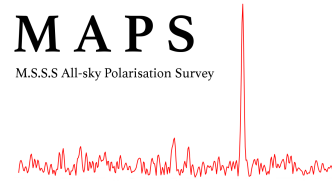
MAPS: Galactic foreground science



- Fan region at 2' resolution

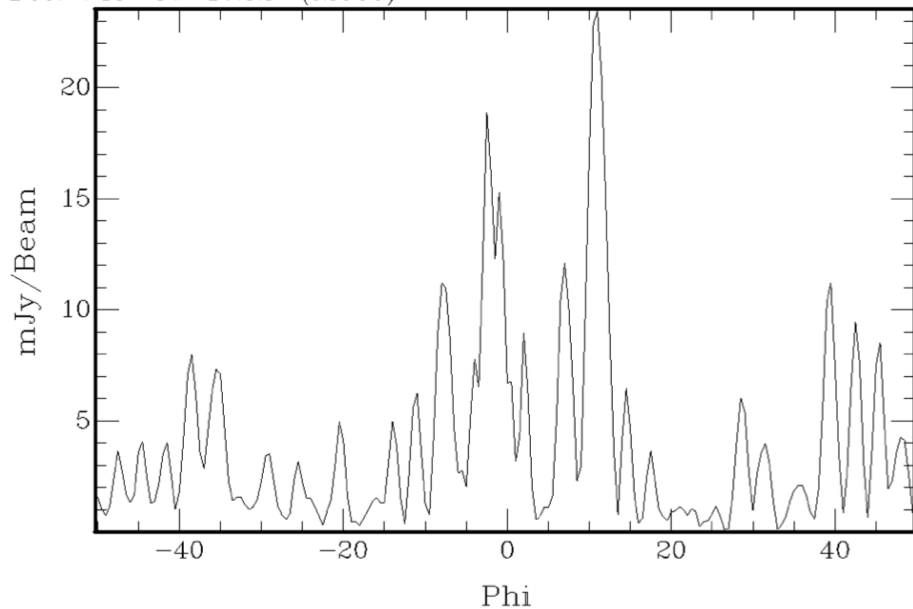


MAPS: extragalactic detection!

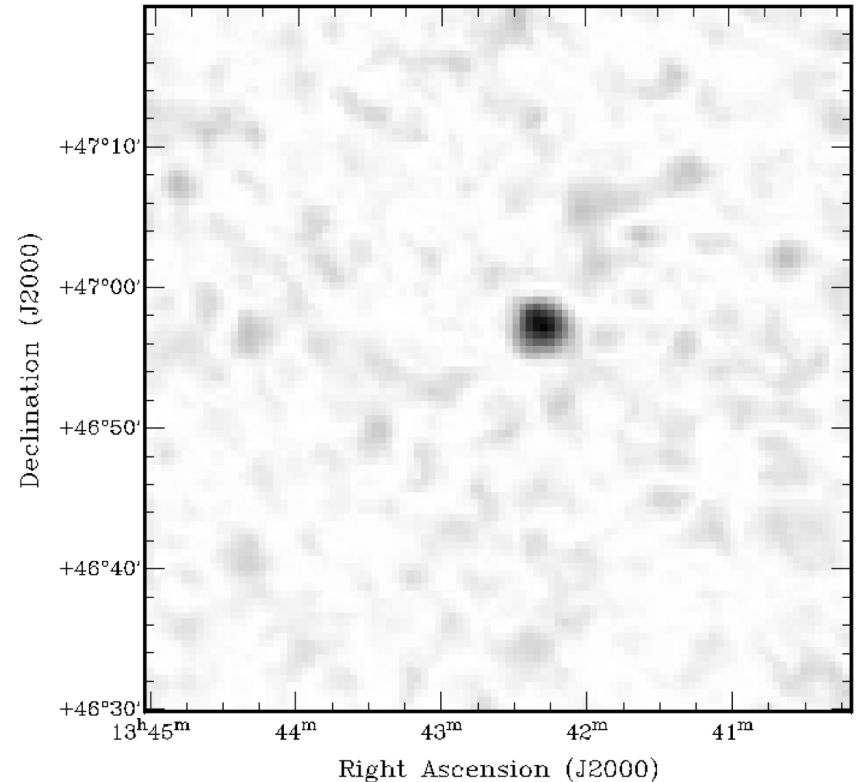


- 4C+47.38 (polarised quasar, $z=0.502$)
- Extragalactic polarisation survey possible with MSSS

Ra: $13^{\text{h}} 42^{\text{m}} 17.19^{\text{s}}$ (J2000)
Dec: $+46^{\circ} 57' 17.92''$ (J2000)



Phi: $1.050000\text{e}+01$



J. Munro (Franklin & Marshall)

Thank you

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