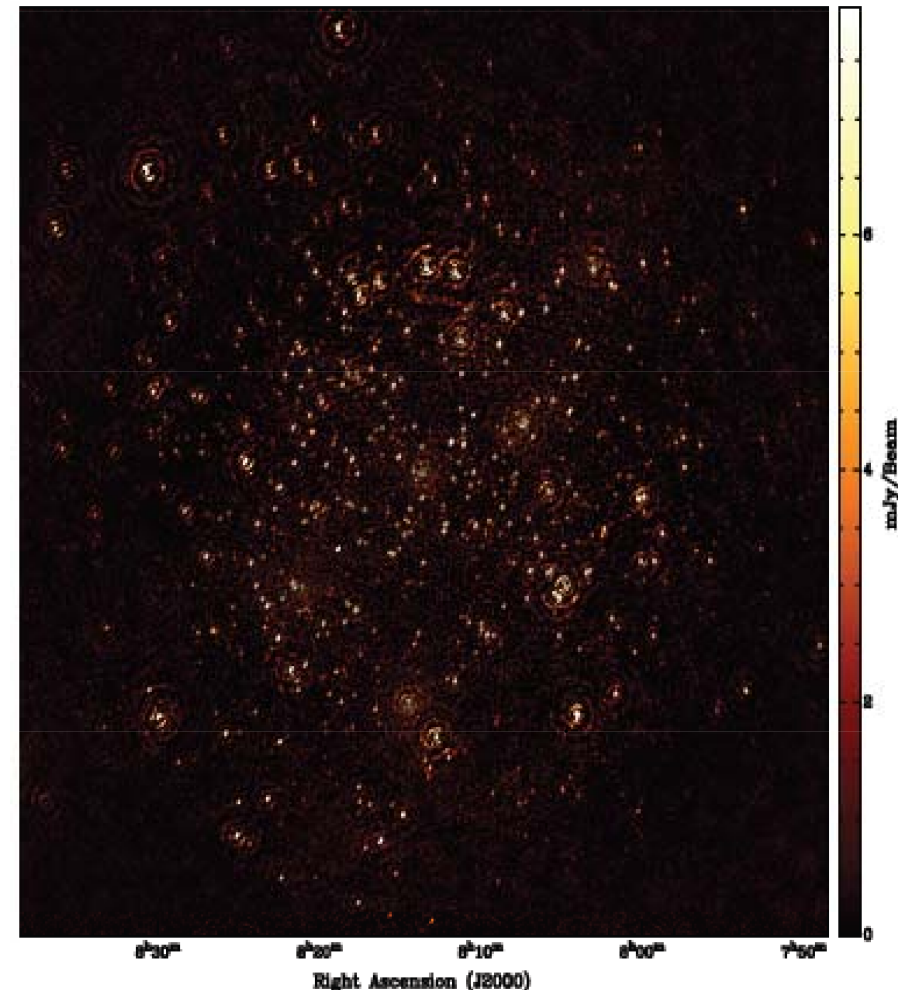# Identifiability of DDEs

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Image fidelity

- Only DR not sufficient to assess image quality

- Example: high DR, low fidelity

- How to define fidelity?

  - sims: can we reconstruct what we've put in?

  - obs: no answer yet

- **need to rely on validity of data reduction methods!**

No "absolute phase"

- scalar ME: $v_{ij} = g_i \, \sigma \, g_j^*$

- replace $g_i' = g_i \, e^{j\varphi}$ and $g_j' = g_j \, e^{j\varphi}$

- update ME: $v_{ij}' = g_i' \, \sigma \, g_j' = g_i \, e^{j\varphi} \, \sigma \, g_j^* \, e^{-j\varphi} = v_{ij}$

- **Phase is not identifiable from visibilities**

- DDE fits based on DD phase have fundamental flaw!

- **Such approach does not help for credibility**

- **MeqTrees does not protect you (SVD solver)**

Unitary ambiguity (UA)

- full pol ME: $\mathbf{V}_{ij} = \mathbf{J}_i \, \Sigma \, \mathbf{J}_j^H$

- full pol ME for unpol source: $\mathbf{V}_{ij} = \mathbf{J}_i \, \sigma \, \mathbf{J}_j^H$

- replace: $\mathbf{J}_i' = \mathbf{J}_i \, \mathbf{U}$ and $\mathbf{J}_j' = \mathbf{J}_j \, \mathbf{U}$

- update ME: $\mathbf{V}_{ij}' = \mathbf{J}_i' \, \sigma \, \mathbf{J}_j'^H = \mathbf{J}_i \, \mathbf{U} \, \sigma \, \mathbf{U}^H \, \mathbf{J}_j^H = \mathbf{V}_{ij}$

- **Measurements on unpolarized source leave UA**

- DDE fits based on unpolarized calibrators are flawed!

- **Such approach does not help for credibility**

- **MeqTrees does not protect you (SVD solver)**

Proper techniques

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Differential measurements

- Observe phase *differences* between antennas

- Examples

  - differential gains (Smirnov)

  - holography (beam measurements, Brisken)

Indirect measurements

- Observe source position shifts, flux variations, etc.

- Example: rubber sheet for ionospheric phase screen (MWA, Intema)

Example: beam modeling with CBFPs

- hybrid modeling presented by Ivashina on Friday

- paper by Maaskant, Ivashina, Wijnholds and Warnick

- paper identifies issues with hybrid modeling

- reduces accuracy

- live demo of impact of phase ambiguity

Conclusion

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Solver abuse can kill[*] instantly

[*]your MeqServer

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The unitary ambiguity

~~Solver abuse~~ can kill* instantly

*your ~~MeqServer~~

the credibility of your solutions