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Fundamental Limit of Polarimetric Calibratability

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There is a widespread myth in radio astronomy that says that complete knowledge of antenna beam gains will lead to perfect calibration and hence, perfect images.

I show that this is almost never true in practice.

I will present a fundamental bound on the error of fully calibrated data.

This “error bar” on the final image shows that even for completely known gains, there is, in addition to thermal noise, polarimetric noise due to the ill-conditioning of the Jones matrix of the telescope.

This polarimetric noise affects not only polarized sources, but also unpolarized sources, thus affects all imaging.

This effect can be seen as the fundamental limit of calibration.

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