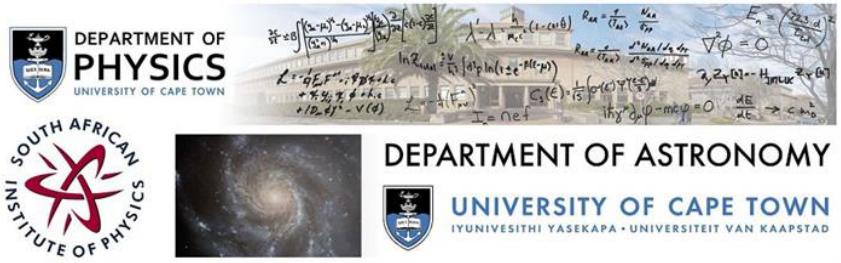

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Modeling the JVLA primary beam using characteristic basis function

Thursday, 7 July 2016 09:40 (20 minutes)

Abstract content
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Accurate modeling of the antenna primary beam response (also known as the antenna radiation pattern) is important in many wireless applications, but is particularly crucial for the next generation of radio telescopes, since they offer unprecedented levels of sensitivity, at which even the most subtle instrumental effects become important. Electromagnetic and optical simulations can only provide a first-order model; real-life primary beam patterns differ from this due to various subtle effects such as (a priori unknown) mechanical deformation, etc. Ideally, a parameterized model is required, so that these effects can be calibrated for in a closed-loop manner. Instances of actual patterns can be measured through a process known as holography, but this is subject to noise, radio frequency interference, and other measurement effects. We present a set of holography measurements for a subset of dishes of the Karl G. Jansky Very Large Array telescope (JVLA US), and discuss the problem of using these measurements to derive parameterized models of the primary beam. We show that the beams exhibit complicated frequency behaviour due to standing waves (resonance) in the optics, particularly in the polarization terms. We discuss the potential application of a technique called characteristic basis function patterns (CBFPs) to these data, which offers the possibility of deriving a parameterized model that can accommodate subtle variations in the beam pattern.

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Oleg Smirnov, osmirnov@gmail.com, Julien Girard, jgirard@ska.ac.za

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Primary author: Mr IHEANETU, Kelachukwu (Rhodes University)

Presenter: Mr IHEANETU, Kelachukwu (Rhodes University)

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