

Snapshot Imaging for Cas A

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Method

The output of the correlator

$$R(t) = \exp \left[-i\omega \left(\frac{\mathbf{B} \cdot \mathbf{s}_0}{c} - \tau(t) \right) \right] \Delta\nu \iint A(\boldsymbol{\sigma}) I(\boldsymbol{\sigma}, t) \exp \left(-i\omega \frac{\mathbf{B} \cdot \boldsymbol{\sigma}}{c} \right) d^2\boldsymbol{\sigma} \quad (1)$$

At transit time t_0

$$R(t_0) = \exp \left[-i\omega \left(\frac{\mathbf{B} \cdot \mathbf{s}_0}{c} - \tau(t_0) \right) \right] \Delta\nu \iint A(\boldsymbol{\sigma}) I(\boldsymbol{\sigma}, t_0) \exp \left(-i\omega \frac{\mathbf{B} \cdot \boldsymbol{\sigma}}{c} \right) d^2\boldsymbol{\sigma} \quad (2)$$

In a short period, τ does not change with t ,

$$\begin{aligned} R(t)R^*(t_0) &= \Delta\nu^2 \iint A(\boldsymbol{\sigma}) I(\boldsymbol{\sigma}, t) \exp \left(-i\omega \frac{\mathbf{B} \cdot \boldsymbol{\sigma}}{c} \right) d^2\boldsymbol{\sigma} \cdot \\ &\quad \iint A(\boldsymbol{\sigma}) I(\boldsymbol{\sigma}, t_0) \exp \left(-i\omega \frac{\mathbf{B} \cdot \boldsymbol{\sigma}}{c} \right) d^2\boldsymbol{\sigma} \end{aligned} \quad (3)$$

At transit time, Cas A dominate, $I(\boldsymbol{\sigma}, t_0) = S_c \delta(\boldsymbol{\sigma})$, $A(0) = 1$,

$$\begin{aligned} R(t)R^*(t_0) &= S_c \Delta\nu^2 \iint A(\boldsymbol{\sigma}) I(\boldsymbol{\sigma}, t) \exp \left(-i\omega \frac{\mathbf{B} \cdot \boldsymbol{\sigma}}{c} \right) d^2\boldsymbol{\sigma} \\ &= S_c \Delta\nu^2 V(t) \end{aligned} \quad (4)$$

Observation Data

observer: Li Jixia

Use antenna: 1,2,3,4,5,6,7,9,10,11,12,13,16

Observation:

Actual direction error: <0.02

Transit time:

 The UTC time is: 2015/11/10 15:46:40

 And local time is: 2015/11/10 23:46:40

 == Cassiopeia_A ==

 az = 321.45, alt = 68.01

local time is: 2015-11-10 22:51:50

 Power off antenna.

 start observation

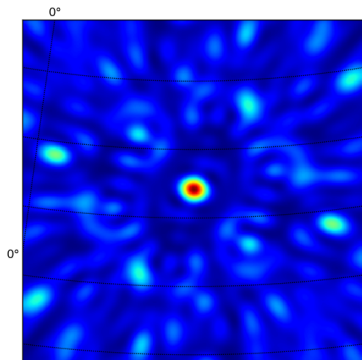
local time is: 2015-11-11 9:37:0

 stop observation

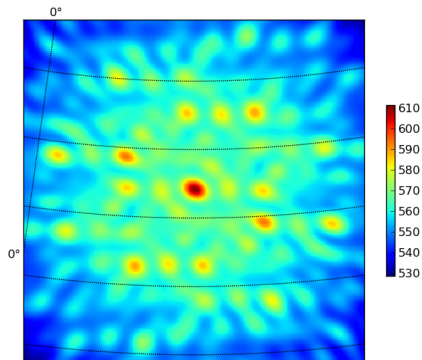
Using data during the transition time.

Synthesized Beam and Dirty Image

Snapshot Image for Cas A for all frequencies synthesis



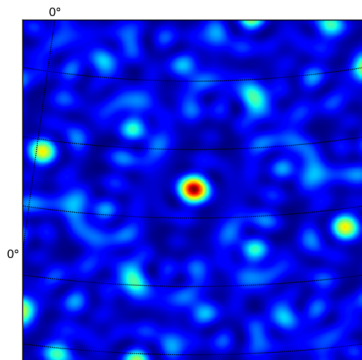
(a) Synthesized beam



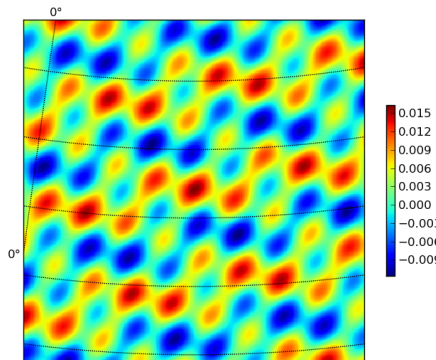
(b) Dirty image

Synthesized Beam and Dirty Image

Snapshot Image for Cas A at 685 MHz



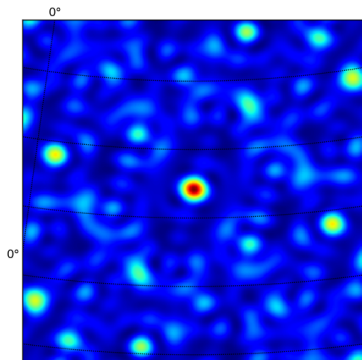
(c) Synthesized beam



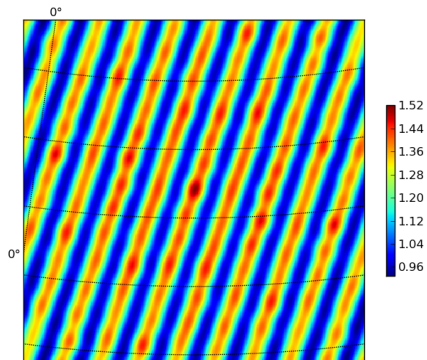
(d) Dirty image

Synthesized Beam and Dirty Image

Snapshot Image for Cas A at 750 MHz



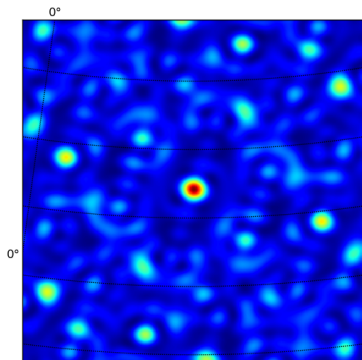
(e) Synthesized beam



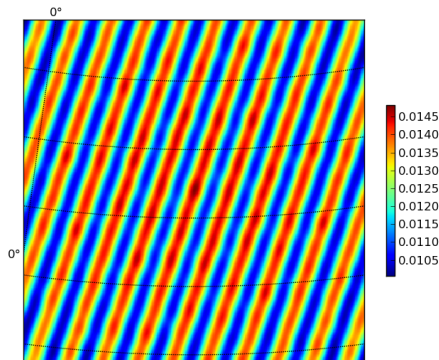
(f) Dirty image

Synthesized Beam and Dirty Image

Snapshot Image for Cas A at 890 MHz



(g) Synthesized beam



(h) Dirty image