

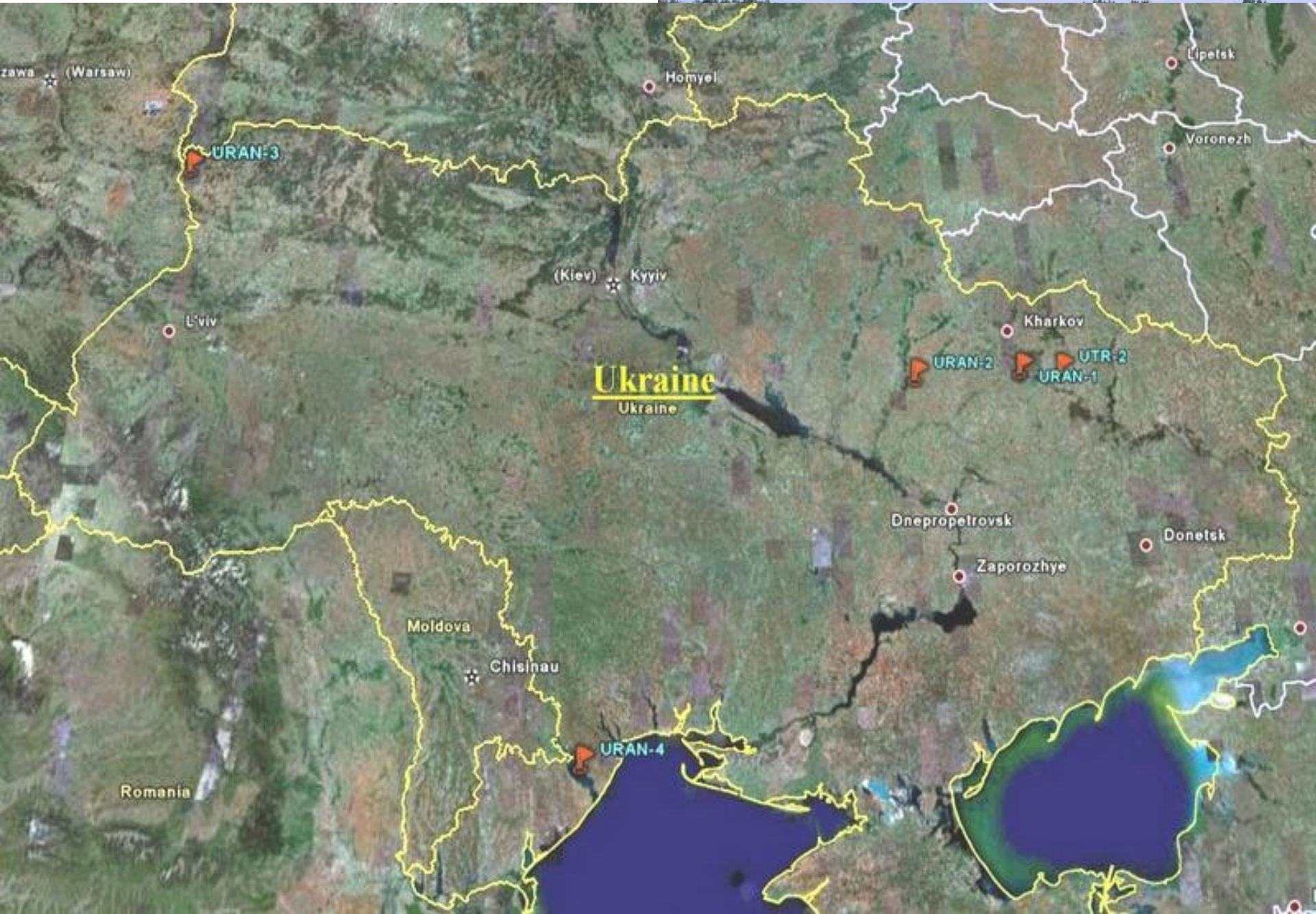
# Extragalactic Radio Sources at Low Frequencies

**Valeriy Shepelev**

*Institute of Radio Astronomy  
National Academy of Sciences of Ukraine  
Kharkov*

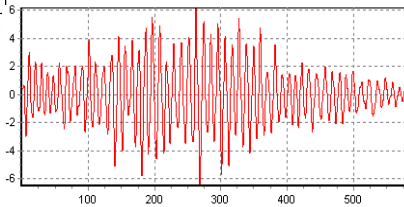
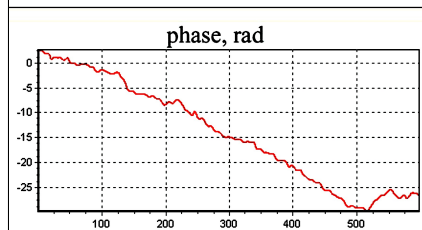
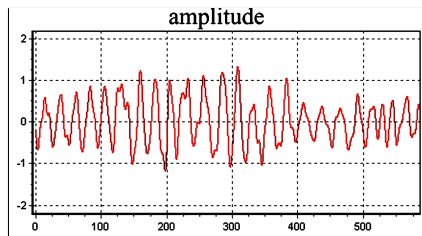
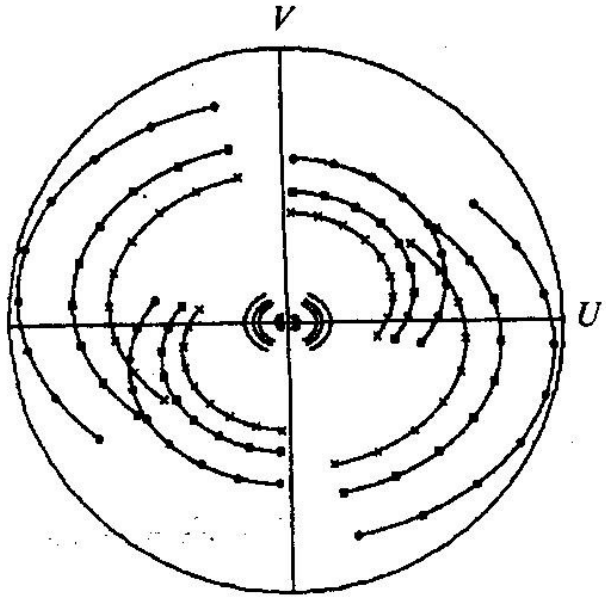
**Astrophysics in the LOFAR era  
23 - 27 April 2007, Emmen**

# Ukrainian Radio Astronomy Network



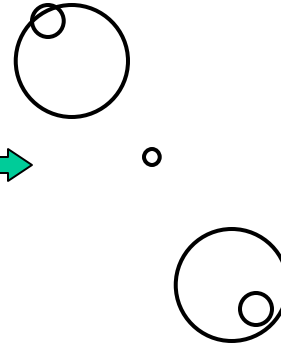
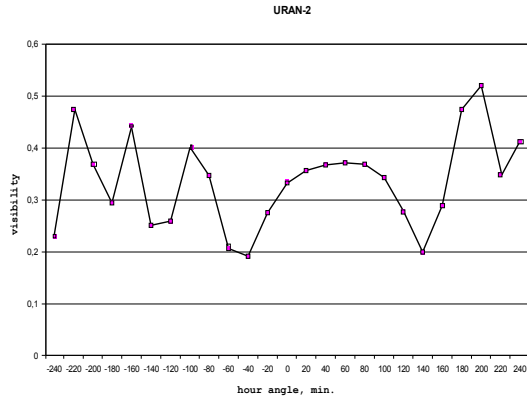
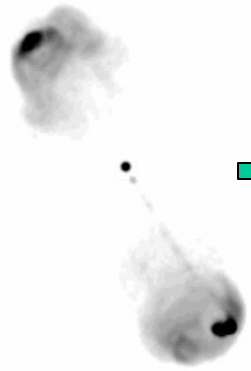
## Main parameters of the URAN

Array	N-S arm of UTR-2	URAN-1	URAN -2	URAN -3	URAN -4
<b>Frequency range</b>	<b>16-25MHz</b>				
<b>Nom. of dipoles</b>	<b>1440</b>	<b>96</b>	<b>512</b>	<b>256</b>	<b>128</b>
<b>Dimensions (m)</b>	<b>53 x 788</b>	<b>238 x 28</b>	<b>238 x 118</b>	<b>238 x 58</b>	<b>238 x 28</b>
<b>Polarization</b>	<b>linear</b>	<b>two linear (cross dipoles)</b>			
<b>Eff. area m<sup>2</sup></b>	<b>~100000</b>	<b>~5500</b>	<b>~28000</b>	<b>~14000</b>	<b>~7000</b>
<b>Array beam</b>	<b>20°x 27'</b>	<b>3°,5 x 30°</b>	<b>3°,5 x 7°</b>	<b>3°,5 x 15°</b>	<b>3°,5 x 30°</b>
<b>Interferometer resolution (25MHz)</b>		<b>15''</b>	<b>4''</b>	<b>0,7''</b>	<b>1''</b>

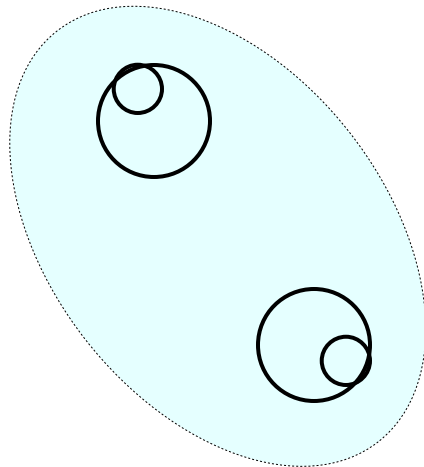
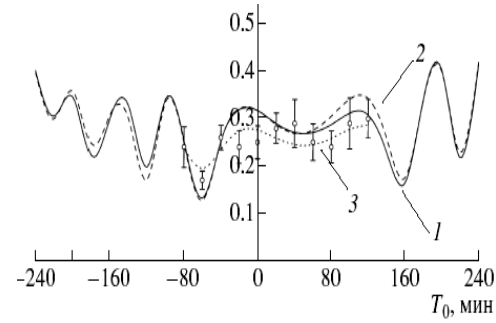
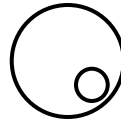
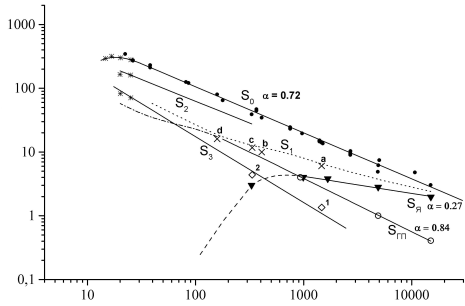


**URAN – 1,2,3,4 with UTR-2  
at the frequencies 16.7, 20, and 25 MHz**

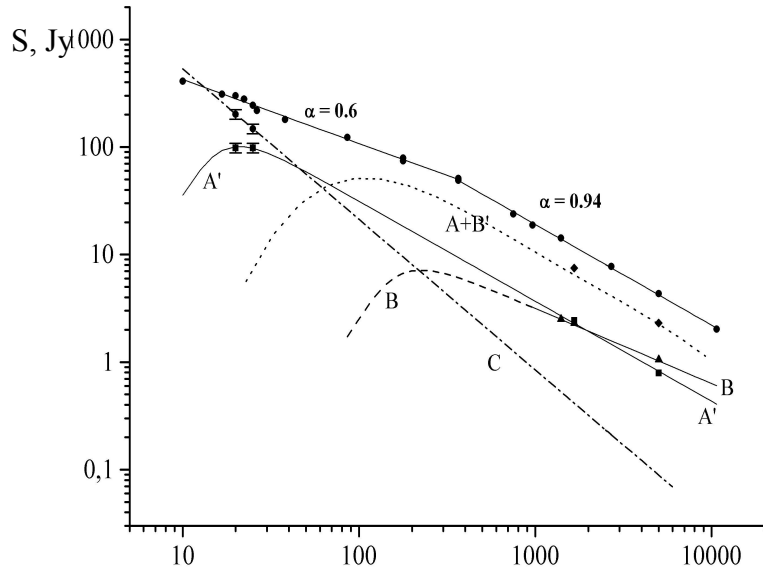
# A model fitting technology



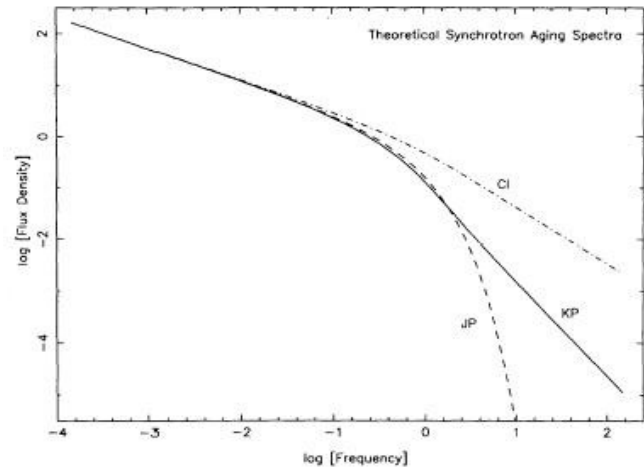
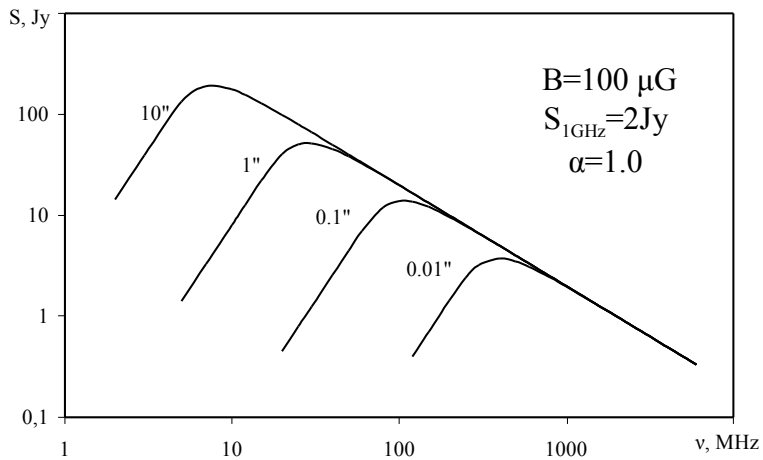
Component	$\Delta\alpha_i$	$\Delta\delta_i$	$\Delta\theta_{\alpha_i}$	$\Delta\theta_{\delta_i}$
Compact	0"	0"	$3'' \pm 0.8''$ (4.8 ± 1)	$3'' \pm 0.8''$ (4.8 ± 1)
First extended	$35 \pm 2$	$185 \pm 14$	$20 \pm 3$	$20 \pm 3$
Second extended	$45 \pm 5$	$40 \pm 19$	$14 \pm 6$	$14 \pm 6$



$\Delta\alpha_i$	$\Delta\delta_i$	$\Delta\theta_{\alpha_i}$	$\Delta\theta_{\delta_i}$
0"	0"	$3'' \pm 0.8''$ (4.8 ± 1)	$3'' \pm 0.8''$ (4.8 ± 1)
$35 \pm 2$	$185 \pm 14$	$20 \pm 3$	$20 \pm 3$
$45 \pm 5$	$40 \pm 19$	$14 \pm 6$	$14 \pm 6$



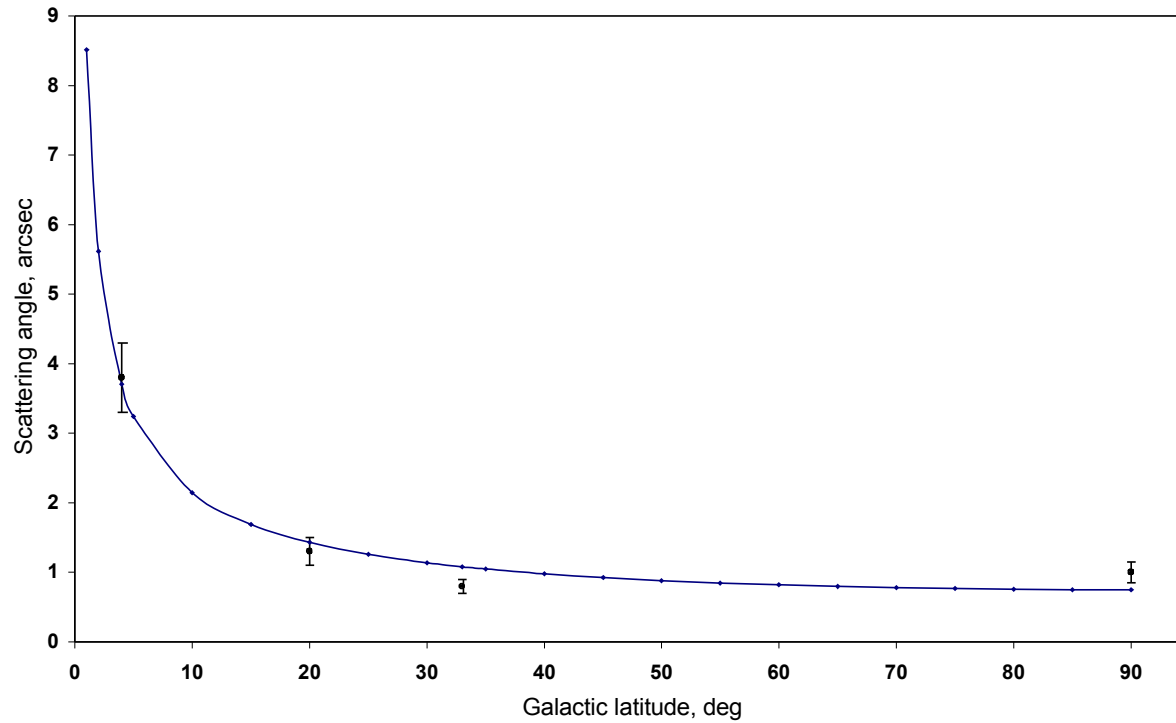
Synchrotron self-absorption  
 Synchrotron losses (aging)  
 Free-free absorption



# Interstellar scattering

$$\theta_p \cong 20(\lambda / 0.1)^{2.2} (\sin b)^{-0.6}$$

*Shishov, V.I. Astronomy Reports, V. 45, 2001*



# 3C134

2700 MHz VLA



20 MHz URAN



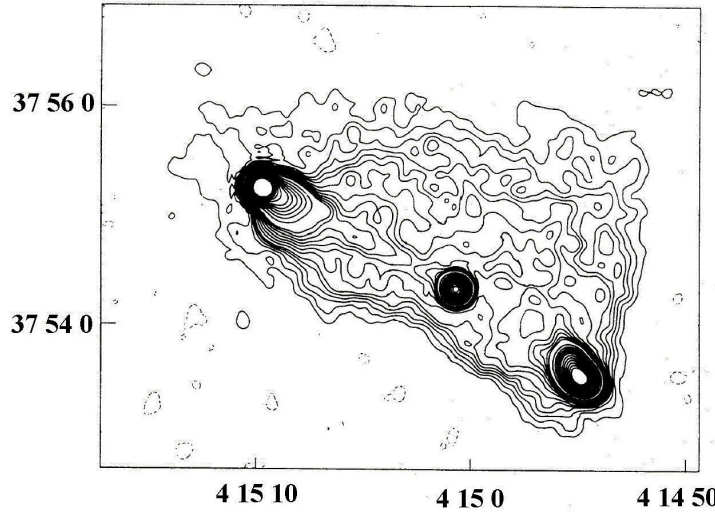
detail	$\Delta\alpha''$	$\Delta\delta''$	$S_i/S_0$	$\Delta\theta''_i$ <i>max</i>	$\Delta\theta''_i$ <i>min</i>	$\Psi^\circ$
1	0	0	0.54	48	20	16
2	23	130	0.46	40	15	13

detail	$\Delta\alpha''$	$\Delta\delta''$	$S_i/S_0$	$\Delta\theta''_i$ <i>max</i>	$\Delta\theta''_{i\min}$	$\Psi^\circ$
1	0	0	$0.48\pm 0.1$	$63\pm 6$	$25\pm 3$	16
2	$24\pm 0.6$	$98\pm 3$	$0.52\pm 0.1$	$58\pm 4$	$28\pm 2$	13

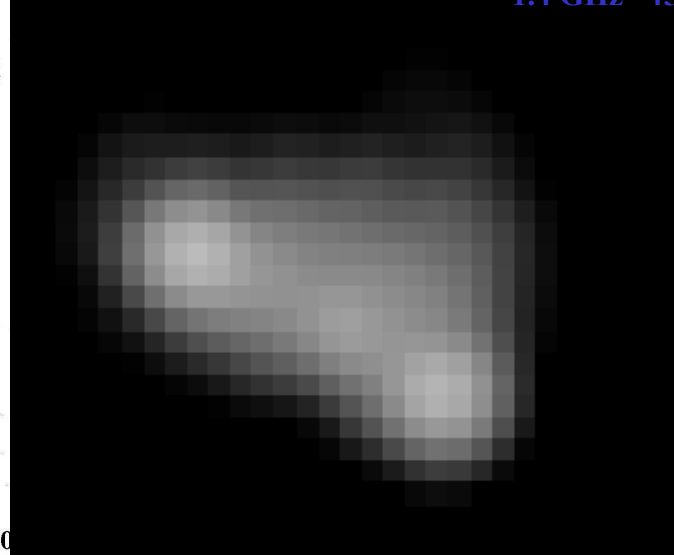


# Radio galaxy 3C111

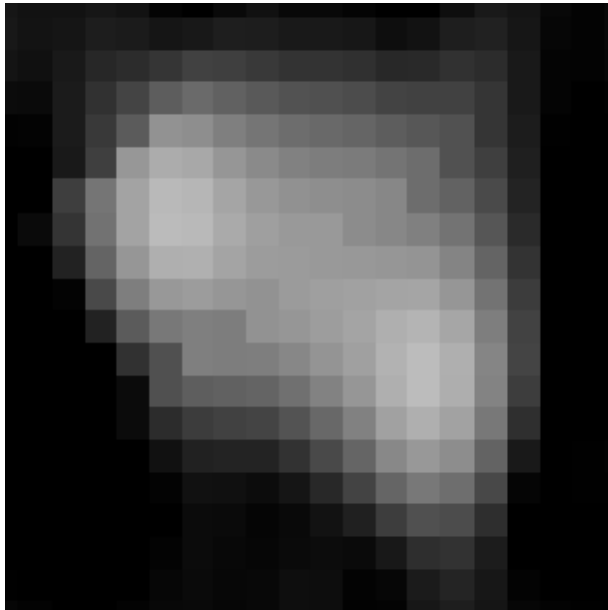
1.4 GHz 10" VLA



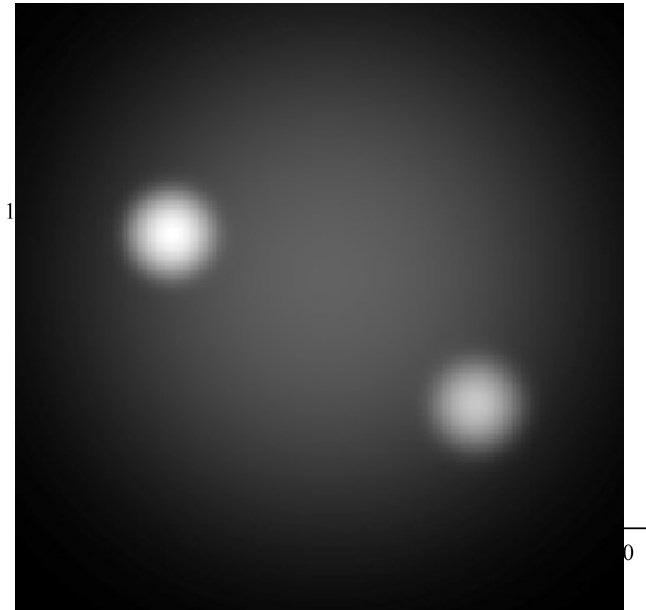
1.4 GHz 45" VLA (NVSS)



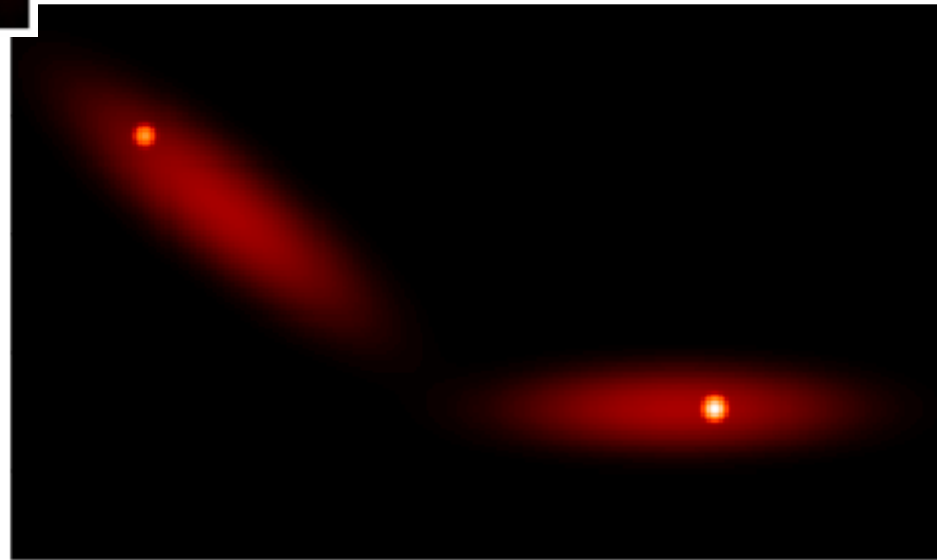
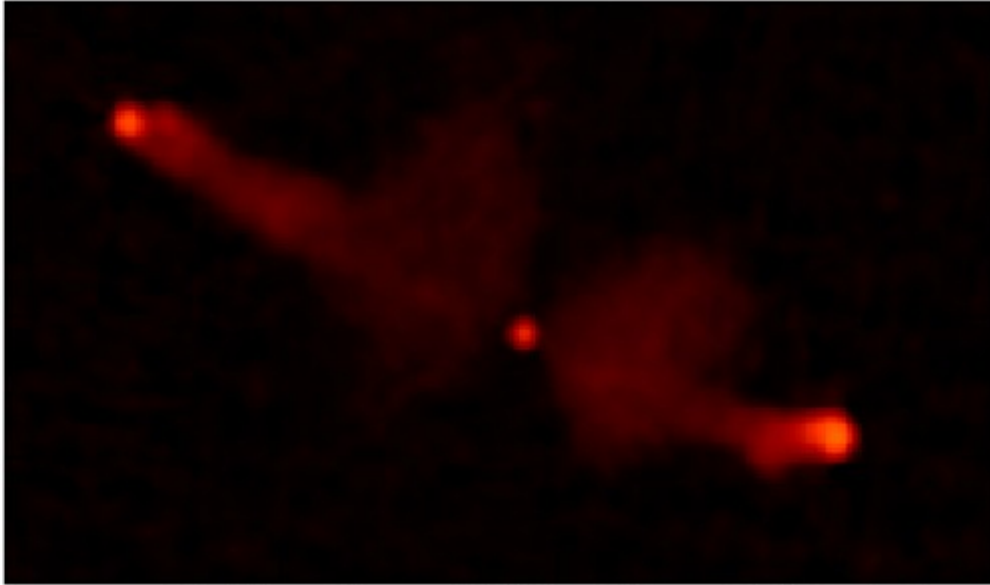
325 MHz 55" WENS



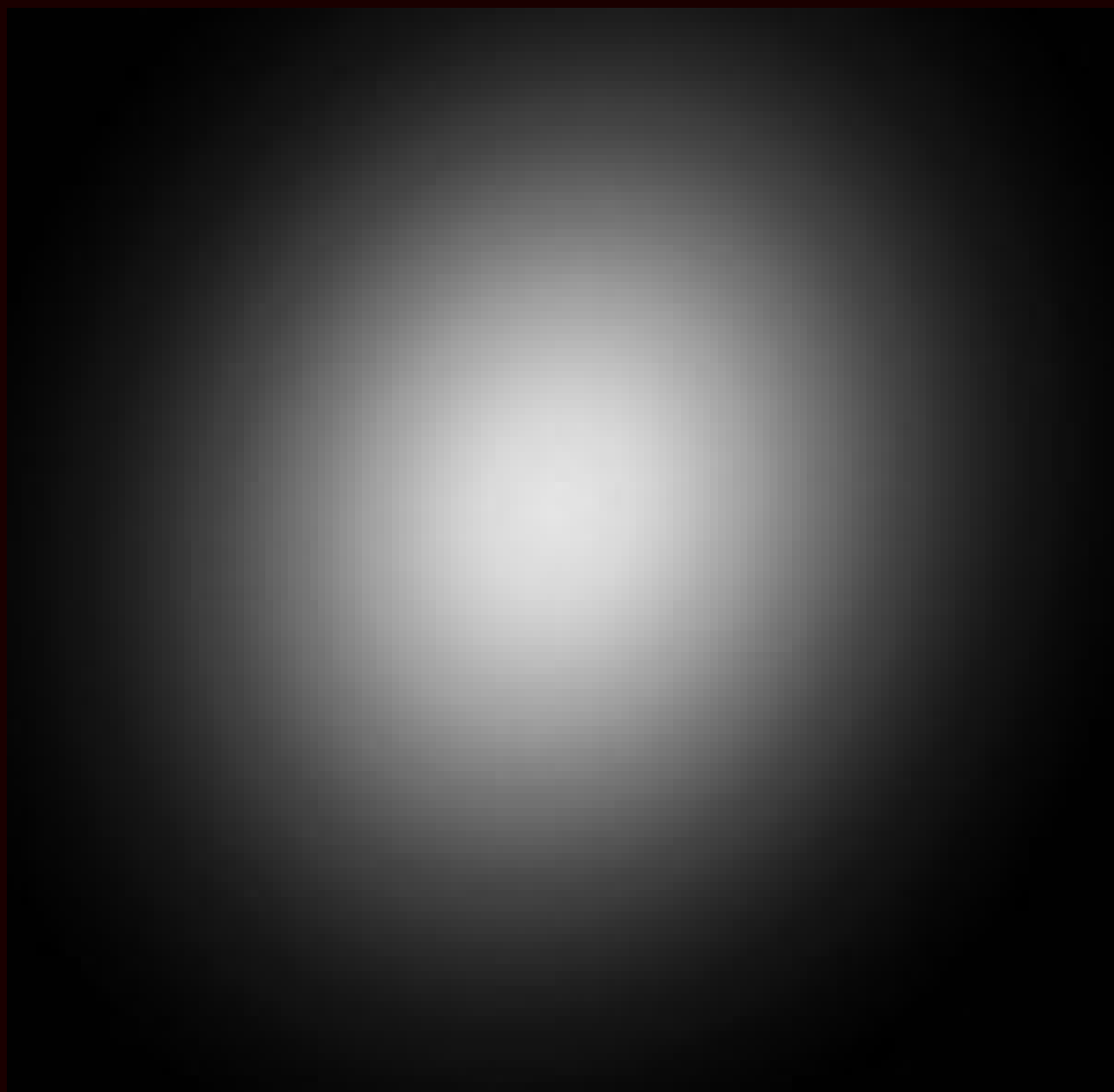
25 MHz 15" URAN



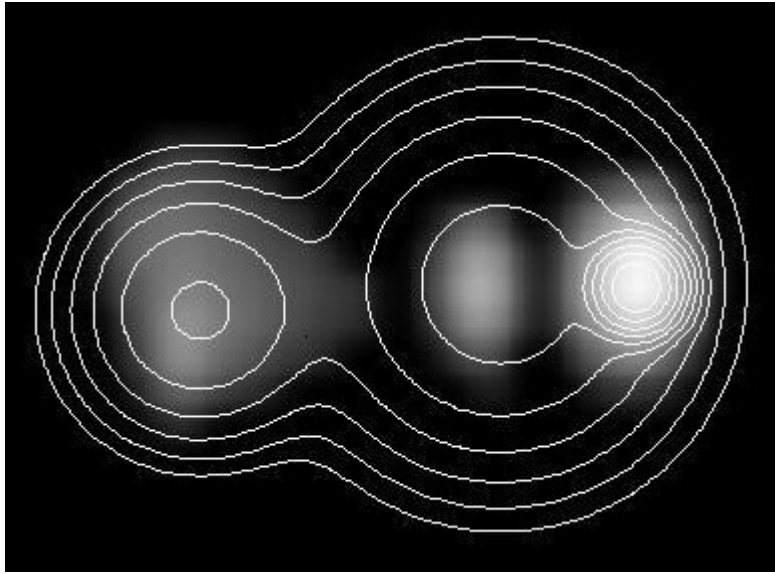
## Radio galaxy 3C234



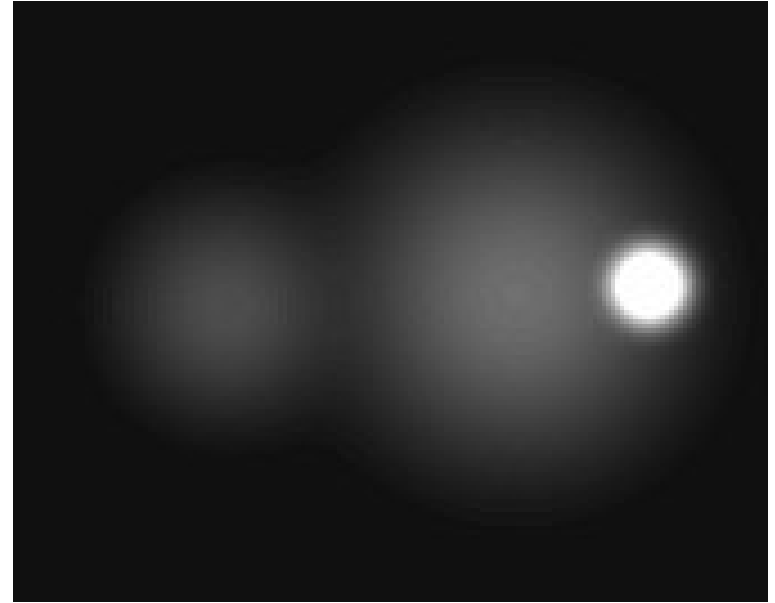
## Radio galaxy 3C295



## Quasar 3C154

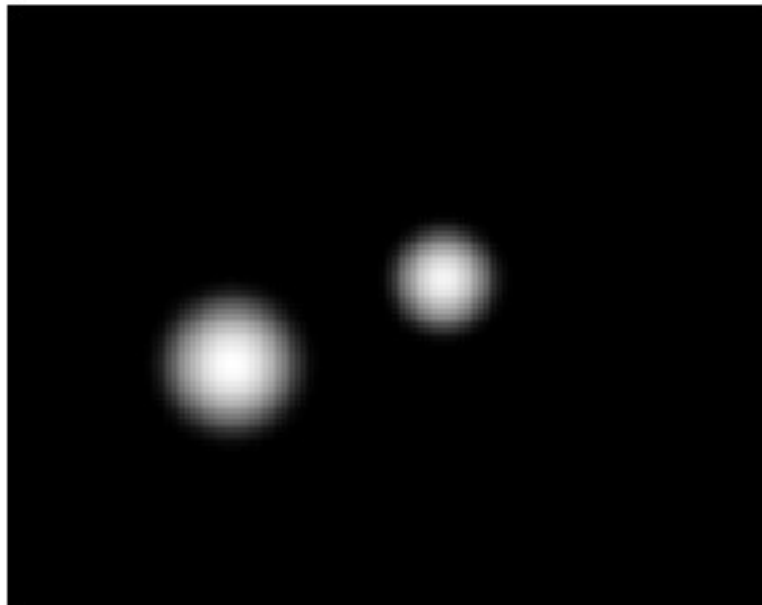


VLA 1.4 GHz 4'' x 9'' + URAN isophotes

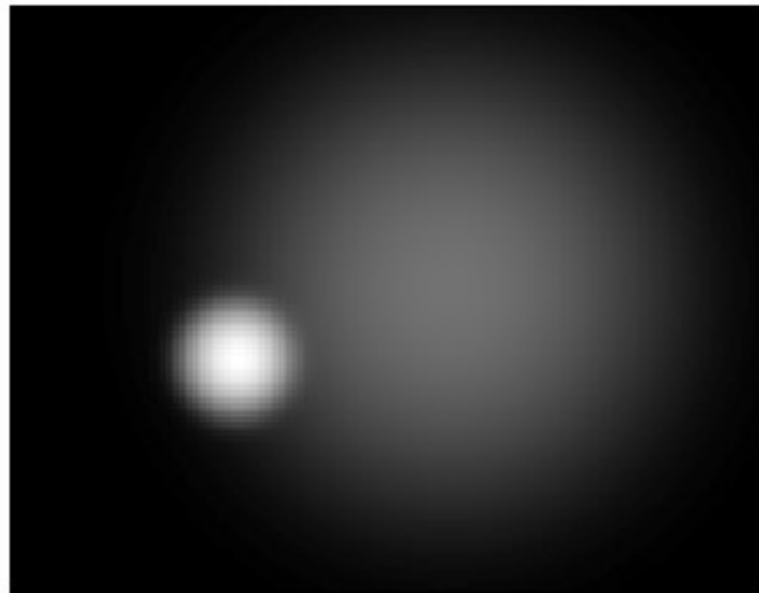


URAN grayscale

# Quasar 3C254

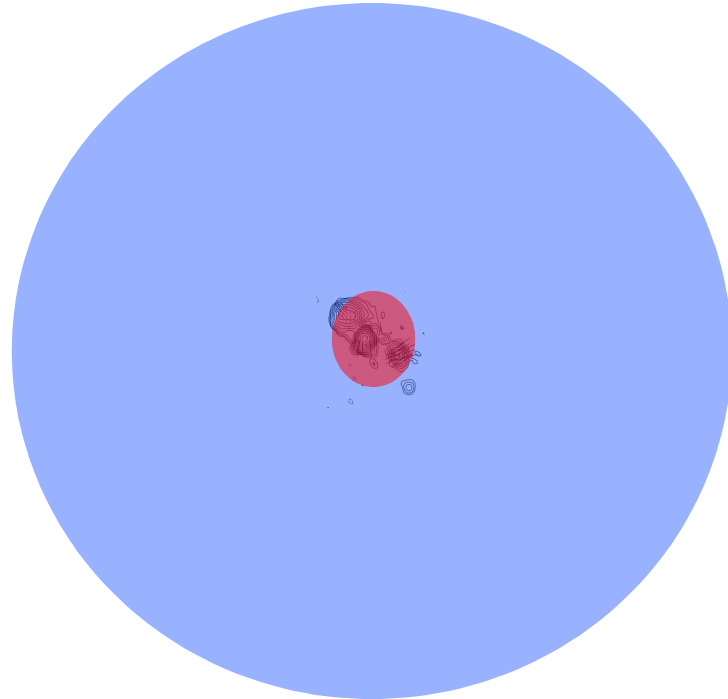
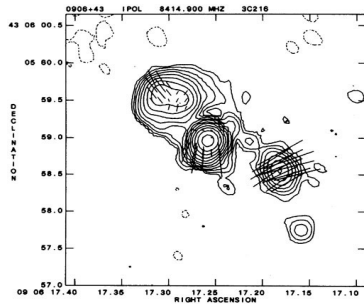


**Initial model**



**25 MHz URAN model**

# Quasar 3C216

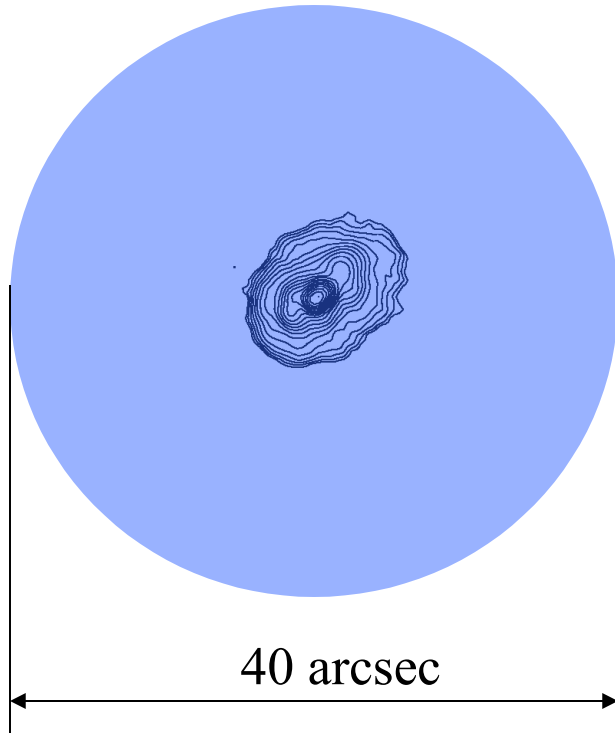


$$S_0 = 70 \text{ Jy}$$

2" ( $0.6S_0$ ) and 20" ( $0.4S_0$ )

Extended component will have  
5 Jy at 100 MHz  $\sim$  10 mJy/beam

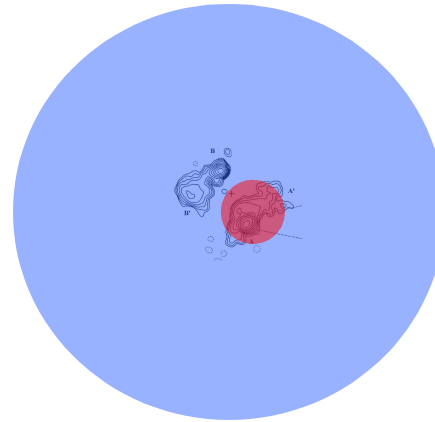
**3C380**



40 arcsec

5mJy/beam at 100 MHz

**3C196**



25 arcsec

20 mJy/beam at 100 MHz

# The main peculiarities of the brightness distribution in the decameter range:

- **Cores – disappear completely.**
- **Hot spots – disappear or less prominent at least.**
- **If exist the hot spots are enlarged by the interstellar scattering.**
- **Lobes – enlarged and their spectral indexes are smaller than those measured at higher frequencies due to aging.**
- **Extended components with steep spectra and low surface brightness have been detected.**





**Low frequency investigations**

**will be**

**continued**