IAU Colloquium 164: Radio Emission from Galactic and Extragalactic Compact Sources
ASP Conference Series, Vol. 144, 1998
J. A. Zensus, G. B. Taylor, & J. M. Wrobel (eds.)

Comparison of Total Flux and VLBI Properties of a Sample of 15 AGN at 22 GHz

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Abstract. A sample of 15 bright AGN has been observed at 22 GHz with two epoch global VLBI observations. The sample consists of all sources in the complete 2 Jy catalogue of Valtaoja et al. (1992) previously unobserved at 22 GHz VLBI. We have begun to investigate how much structural information can be derived just from total flux density (TFD) monitoring and how to use total flux density observations to complement space VLBI observations. As an example we present Doppler boosting factors derived in four different methods.

Our sample is based on the complete Northern hemisphere sample of compact AGN (Valtaoja et al. 1992). The selection is based on the high frequency characteristics of AGN, using the selection criterion $S(22\ \text{GHz}) > 2$ Jy combined with the experience from the Metsähovi and SEST total flux density monitoring. The 47 sources which fulfill our criteria are bright and likely very compact, so they are prime candidates to be observed with space VLBI.

It would not have been feasible to observe all of these sources, so an additional criterion was used. 15 of these 47 sources were not observed previously using 22 GHz VLBI and thus these form our sample. This sample is representative since it includes all the main classes of AGN. Five of the 15 sources observed in this project were selected to the comparison mainly because of their well definable and identifiable components (Table 1).

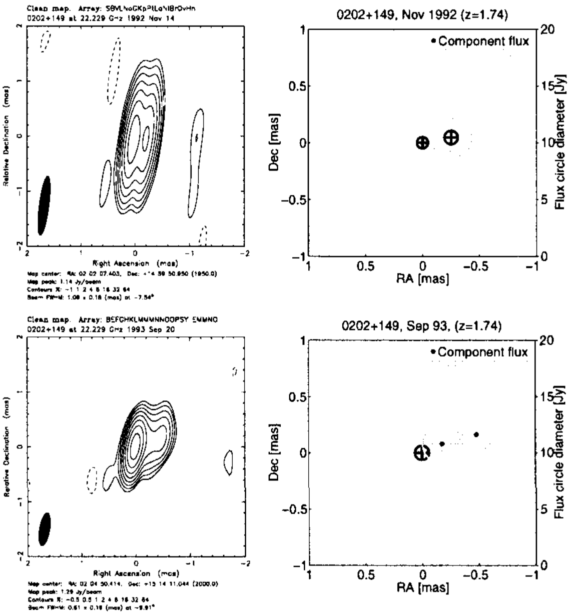
The experiments were carried out in November 1992 (GL10, Mk II, 15 telescopes), September 1993 (GL13, MkIIIE, 17 telescopes), and November 1996 (GW14, MkIIIE, 17 telescopes). The data for the third experiment was correlated successfully in February 1997, but is not included in this paper.

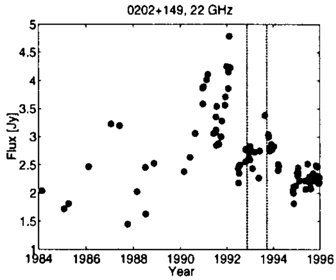
Table 1. Summary of the Derived Doppler Boost Factors

Source	**0106+013**	**0202+149**			**0528+134**	**1413+134**		**1749+096**	
Comp.	1993.6	1992.1		1993.6	1993.5	1992.9		1993.1	
Expt.	GL13	GL10	GL13	GL13	GL13	GL10	GL13	GL10	GL13
D_1	2.6	4.2	3.2	6.0	6.2	10.9	–	6.0	3.2
D_2	5.1	32	18	25	15.8	27.1	28	4.0	–
D_3	5.3	6.6	9.2	23	24.5	47	–	10.5	6.5
D_4	< 1	1.8	< 1	< 1	< 1	< 1	< 1	> 2	< 1
v/c	–		11		–	≥ 2.4		≥ 2.5	

The Doppler boosting factors can be estimated in four different ways by using brightness temperatures from TFD monitoring and the limiting brightness temperature (in this paper $T_{B,max} = 5 \times 10^{10}$ K, see Lähteenmäki & Valtaoja, these Proceedings, p. 135), component sizes from VLBI observation and TFD monitoring, the brightness temperatures derived from TFD and VLBI and the brightness temperature from VLBI, and the limiting brightness temperature $T_{B,max}$ (D1, D2, D3 and D4, respectively, see Valtaoja, these Proceedings, p. 35). This is possible because the observed VLBI and TFD parameters have different

https://doi.org/10.1017/S025292110004495X Published online by Cambridge University Press





0202+149

Comp.	1992.1		1993.6
Expt.	GL10	GL13	GL13
D_1	4.2	3.2	6.0
D_2	32	18	25
D_3	6.6	9.2	23
D_4	1.8	< 1	< 1

$\mu = 0.29$ mas/y $\Rightarrow$ v/c = 11

Figure 1. Example of the dataset used in the comparison (0202+149). At left are the two-epoch VLBI maps, at center are plots of the model fits with relative flux in black and component size in grey and at upper right the flux monitoring data with the two VLBI epochs marked with dashed lines.

dependences on D and the intrinsic brightness temperature. Unfortunately, the space available will not permit presenting neither the formulas nor the derivation.

The differently derived boost factors (Table 1) are in general self-consistent. Differences are mainly due to too large VLBI-derived component size, which can be caused by noise, several merged components, poor calibration or a bad model. The optically thin sphere model, which was used in this comparison is clearly too simplistic even for these simple sources. Sources which can be modeled by simple functions (Gaussian or optically thin spheres) give very good agreement.

References

Valtaoja, E., et al. 1992. *A&AS*, **95**, 73–85.