COMPACT DOUBLES: A GENUINE OR ILLUSORY CLASS? +

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Symmetric, two-sided morphology seems to argue against relativistic effects dominating compact radio emission. This kind of structure has been reported for a number of sources (Phillips and Mutel 1982; Pearson 1983) based on maps made at one frequency. Various arguments, all indirect, can be made for these sources being (1) Twin regions formed at the ends of jets which emerge from an invisible core, or (2) misidentified core-jet sources wherein the core and an unusually bright knot are wrongly taken to be a "double." A telling test of both hypotheses is to map the sources in question over an octave or so of frequency. Proponents of view (1) would predict that the two double components will show nearly identical spectral indices and that weak central cores with flat or rising spectra might even be revealed. Champions of view (2) would predict that one end or the other will dominate at high frequencies (the core!) or that complex bridges of emission (the jet!) will be revealed between the components at low frequencies. We have followed our initial discovery of 5 symmetric compact doubles by (A) attempting to enlarge the sample of symmetric sources available to study, and (B) by investigating at 5 GHz those doubles for which the best maps exist at 1.7 GHz.

A. RESULTS OF THE SEARCH FOR DOUBLES

Two Mark II VLB sessions were carried out at 1.7 GHz, observing the next 10 strongest sources showing self-absorption between 0.5 and 1.5 GHz and an optically thin spectral index $\alpha \leq -0.6$. We chose these empirical criteria to eliminate "flat" spectrum sources and because they are an amalgam of spectral properties seen in the original 5 compact doubles. The results can now be summarized. Six of the ten are single component "core" objects slightly resolved with 0".006 resolution; three are complex. Only 1225+36 shows a double morphology: it is an unequal (2:1 brightness ratio) double, ~0".020 in size. It appears that many simple spectra are formed by sources that are simple! Our earlier choices seem to have fortuitiously been doubles.

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B. NEW HIGH FREQUENCY MAPS FOR SOME ORIGINAL DOUBLES

We have made maps at 5 GHz for 3 of the original compact doubles. Two, 1518+047 and 2050+363, show detail within one end of the "double." 2050+363 (shown, Fig. 1) shows that the east end of the double, which appeared slightly larger at 1.7 GHz, is actually three bright spots which form a small hook. Though spectral differences are slight, one might now argue that 2050+363 is in fact an asymmetric system with an invisible jet.

A third, CTD 93, shows no particular structure within its major double components. There seems to be a significant spectral gradient across one or both components (outside edge "flatter"). We also find evidence (Fig.2) for a previously unnoticed, third component roughly midway between the two others. While this component is not impressively strong (11% of peak), we have applied gain-correcting algorithms in the mapping process and believe 5-stations maps should be able to attain 9:1 fidelity. The best confirmation of the central object would be corroborative discovery at a higher frequency, at which, presumably, its rising or flat spectrum would make it even more prominent between the two double components.

SUMMARY

Between 20% (Pearson "complete" sample) and 30% (our old and new spectral sample) of compact sources have the "compact double" morphology. While some sources show mild asymmetry when mapped at two or more frequencies, CTD 93 shows no evidence for asymmetry and tentative evidence for a flat spectrum central component. If such a third component can be confirmed, we will be faced with - for the first time - a compact source wherein the apparent core of activity appears not at one end, but in its midst. We conclude that all doubles may not ultimately be symmetric, but that further study has so far been quite illuminating.

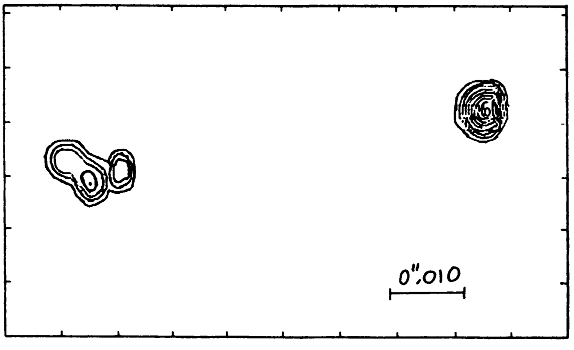

Figure 1. 2050+363

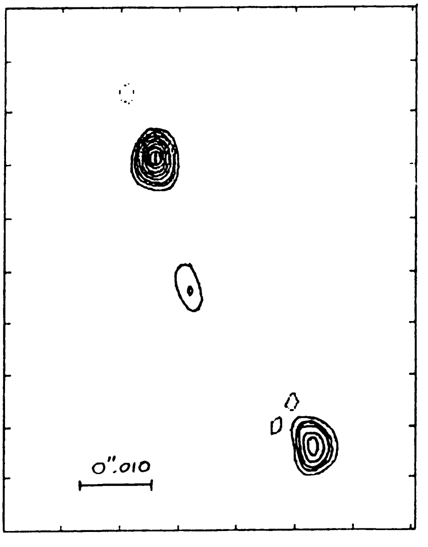

Figure 2. CTD 93

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