Addendum from J. Hindley, T. C. Elleman & G. A. Phear

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The accompanying article by Hartley and Donelson presents the sequence of the type A yeast plasmid recovered from *Saccharomyces cerevisiae* strain A364A D5 by cloning into pMB9. We have independently determined about 63% of the type A plasmid sequence from pJDB 71 (ref. 1; a hybrid constructed by inserting the 2μ plasmid from *S. cerevisiae* strain DR19/8T into the *Eco*RI site of pMB9), using a different approach and have compared the two sets of data. This is of interest for two reasons. First, Hartley and Donelson used the Maxam–Gilbert procedure whereas we have relied entirely on the dideoxynucleotide chain termination procedure using single-stranded templates generated by cloning restriction fragments into linearized phage M13mp2 RF-DNA and subsequently isolating the single-stranded recombinant phages[2]. The sequence comparison was made over a total of 4,004 nucleotides comprising sequences totalling 3,053 nucleotides from the larger and 951 nucleotides from the smaller unique regions of the plasmid. Both sets of data were in complete agreement. This result therefore completely validates the reliability of the newer sequencing procedures used in this work. Neither during propagation of the hybrid plasmid nor in the subsequent M13 cloning and primed syntheses is there any evidence of rearrangements or deletions of sequences.

Second, the data imply that the unique regions in the plasmid, bounded by the inverted repeats, are fully conserved in two unrelated strains of yeast. This identity includes a sequence of 863 nucleotides extending from the *Eco*RI site at position 2,407 to position 3,270. This region contains a set of 6.5 direct tandem repeats of 62–63 residues and in two other plasmid isolates (Scp 2 and Scp 3)[3], which contain deletions of about 130 and 220 base pairs respectively, the mapping data puts both these deletions within the region of tandemly repeated sequences. The available data therefore suggests that, apart from this deletable region, the unique regions of the plasmid are strongly conserved. Differences are found however when the inverted repeat regions are compared. All these seem to be single base changes and occur in regions outside the possible reading frames suggested by Hartley and Donelson (see ref. 4).

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2. Sanger, F., Coulson, A. R., Barrell, B. G., Smith, A. J. H. & Roe, B. A. *J. molec. Biol.* (in the press).
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LETTERS

The double quasar 0957+561 as a gravitational lens: further VLA observations

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The twin quasars 0957+561 A,B, separated by only 6 arc s on the sky, have been shown to have nearly identical redshifts ($z_e \simeq 1.41$, $z_a \simeq 1.39$) by Walsh *et al.*[1], who suggested that they were the double image of a single object, split by the gravitational refraction of an unseen massive intervening object. Further optical spectroscopy[2] has confirmed the remarkable similarities of the emission and absorption spectra of the two quasars, and strengthened the case for a gravitational lens model. Radio maps at 6 cm made with the Cambridge 5-km telescope[3] and with the VLA[4] showed that, in addition to two unresolved sources coincident with the optical quasars, there were extended regions of radio emission, apparently associated with the north (A) quasar which greatly complicated the gravitational lens hypothesis. We now report a full 12-h synthesis made at the VLA at 6-cm wavelength[5] which confirmed the earlier maps and showed additional features at lower flux levels. In particular, this map revealed two small radio 'jets', one close to each of the quasars. The absence of corresponding second images of either of these jets near the other quasar was used to rule out models in which the gravitator was located near the midpoint of the line between A and B (ref. 5).

The lens hypothesis was boosted by the discovery[6,7] that the field of 0957+561 was overlaid by a rich cluster of galaxies at $z \simeq 0.39$. Furthermore, the nucleus of the brightest member of the cluster (designated G1) lay ~1 arc s north of the B quasar, very near the position of the B radio jet. Young *et al.*[7] presented models for gravitational imaging of the underlying object quasar, invoking both the properties of an extended gravitator (G1) and the existence of an additional source of bending (the cluster as a whole) and were able to account for most of the observed features. The B jet, however, remained difficult to understand as part of the gravitational image of the quasar and its extended radio emission. The present results clarify the nature of the B radio jet, and further strengthen the gravitational lens interpretation of the double quasar.

The observations consist of a full 12-h synthesis made at 6 cm on the Very Large Array of the National Radio Astronomy Observatory during 22–23 February 1980. A total of 22 antennas were functioning, with baselines ranging between 45 m and 22.4 km. Observing conditions were ideal, and the data were of significantly higher quality than those obtained in October 1979[5]. The performance of the array was monitored by frequent observations of the nearby point source 1031+567 and the flux scale was set by assuming the 4,885 MHz flux density of 3C286 to be 7.41 Jy. Editing, gridding, and Fourier transformation of the data were carried out using the standard VLA data reduction procedures. The resulting 'dirty' map was processed with the modified CLEAN algorithm of Clark[8]. The clean map, shown in Fig. 1, has a resolution of 0.66 by 0.41 arc s FWHM, and a dynamic range (map peak/r.m.s. noise) of ~200:1.

The significant feature of Fig. 1 is the resolution of the B jet into a point source (which we now denote G) of 2.3 ± 0.2 mJy flux, located 1.06 ± 0.02 arc s N and 0.15 ± 0.02 arc s E of the B quasar. The position and flux of G are consistent with our previous observations[5]. An optical photograph of the field, made on the University of Hawaii 2.2-m telescope by Stockton[9], puts the optical nucleus of G1 0.99 ± 0.03 arc s N and 0.19 ± 0.03 arc s E of the B quasar, or 0.08 ± 0.05 arc s SE of the radio position. Thus, the optical nucleus of G1 and the radio source G are coincident within the small uncertainties. The simplest interpretation is that G is a compact radio source in the nucleus of G1 and is not part of the gravitational image. If this is so, the 5 GHz power of G is $P_{5000} = 1.1 \times 10^{-23}$ WHz^{-1} sr^{-1} ($q_0 = 1/2$, $H_0 = 50$ km s^{-1} Mpc^{-1}, spectral index assumed to be 0.25). Although little is known about the compact radio structure of cD galaxies selected without regard for their low-frequency properties, G is comparable to the central components of 3CR radio galaxies[10]. Although there is at least one other interpretation (see below), the fact that G is not significantly north of the nucleus of G1 removes the last strong objection to the gravitational lens explanation of 0957+561.

0028–0836/80/350865—02$01.00