HIGH-RESOLUTION RADIO OBSERVATIONS OF THE CRABLIKE SUPERNOVA REMNANT 3C 58

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We report Very Large Array[1] observations of 3C 58, the Crab Nebula's closest relative at radio wavelengths. We combined A, B, C, and D configurations (baselines ranging from 0.08 to 35 km) at frequencies of 1446 MHz and 4886 MHz, achieving resolutions of $1\overset{''}{.}9$ and $2\overset{''}{.}5$, respectively, and a sensitivity at both frequencies of about 70 μJy per beam. We deconvolved the point-source response from the images using a maximum-entropy technique. The 1446 MHz total-intensity image shows that filamentation not only dominates the spatial distribution of flux in the bright inner regions, but appears to continue into the faint outer envelope as well. This envelope fades smoothly into the noise over about half the circumference of the remnant; the lowest contours of our map show maximum extents in RA and δ of $10\overset{s}{.}3$ and $6\overset{'}{.}3$ respectively. However, in some places the edge is relatively well-defined, suggesting confinement of some kind. A remarkably jet-like extension can be seen protruding from the south central part of the remnant, with a position angle of about 150° with respect to the radio peak. Unlike the Crab's jet, this is wedge-shaped and somewhat resembles the brighter extension to the north. The X-ray point source (Becker, Helfand, and Szymkowiak 1982, Ap. J. **255**, 557) lies about 30" east of the peak in the radio map. No obvious radio feature coincides with it. We have made spectral-index maps of the remnant, and find only small variations, with little apparent correlation of spectral index with structure. The rms deviation from the remnant mean spectral index is 0.18, but profiles of filaments show less than 0.1 difference in spectral index between peaks and adjacent valleys. Thus the bright filaments are neither flatter nor steeper in spectrum than the remnant mean, ruling out a picture in which bright filaments are locations where shock acceleration produces a steeper particle energy spectrum. Filaments have brightness contrasts of factors of 1.5 to 2, steep edges (<10", sometimes unresolved) and widths of 10" - 30"; if they have similar thicknesses along the line of sight, their emissivity ranges up to 40 - 50 times the remnant mean.

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