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A shock front in the merging galaxy cluster Abell 754: X-ray and radio observations

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We present new Chandra X-ray and Giant Meterwave Radio Telescope (GMRT) radio observations of the nearby merging galaxy cluster Abell 754. Our X-ray data confirm the presence of a shock front by obtaining the first direct measurement of a gas temperature jump across the X-ray brightness edge previously seen in the imaging data. A754 is only the fourth galaxy cluster with confirmed merger shock fronts, and it has the weakest shock of those, with a Mach number $M=1.57+0.16-0.12$. In our new GMRT observation at 330 MHz, we find that the previously-known centrally located radio halo extends eastward to the position of the shock. The X-ray shock front also coincides with the position of a radio relic previously observed at 74 MHz. The radio spectrum of the post-shock region, using our radio data and the earlier results at 74 MHz and 1.4 GHz, is very steep. We argue that acceleration of electrons at the shock front directly from thermal to ultrarelativistic energies is problematic due to energy arguments, while reacceleration of preexisting relativistic electrons is more plausible.

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