

## The generation of magnetic fields in galaxies and clusters of galaxies by the Weibel instability

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We propose that strong magnetic fields should be generated at shock waves associated with the formation of galaxies or clusters of galaxies by the Weibel instability, an instability in collisionless plasmas. The strength of the magnetic fields generated through this mechanism is close to the order of those observed in galaxies or clusters of galaxies at present. If the generated fields do not decay rapidly, this indicates that strong amplification of magnetic fields after the formation of galaxies or clusters of galaxies is not required. This mechanism could have worked even at a redshift of  $\sim 10$ , and therefore the generated magnetic fields may have affected the formation of stars in protogalaxies.