Abstract Submitted
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Turbulent amplification of supernova magnetic fields in the laboratory GIANLUCA GREGORI, University of Oxford — X-ray and radio observations of the supernova remnant Cassiopeia A reveal the presence of magnetic fields about 100 times stronger than those in the surrounding interstellar medium. Field coincident with the outer shock probably arises through a non-linear feedback process involving cosmic rays. The origin of the large magnetic field in the interior of the remnant is less clear but it is probably stretched and amplified by turbulent motions. Turbulence may be generated by hydrodynamic instability at the contact discontinuity between the supernova ejecta and the circumstellar gas. However, optical observations of Cassiopeia A indicate that the ejecta are interacting with a highly inhomogeneous, dense circumstellar cloud bank formed prior to the supernova explosion. We have conducted a series of laboratory experiments using high power laser facilities[1,2] in order to reproduce the essential features of the supernova shock interacting with strong density perturbations. Our results indicate the magnetic field is amplified when the shock interacts with a plastic grid. We show that our experimental results can explain the observed synchrotron emission in the interior of the remnant. These experiments provide an example of magnetic field amplification by turbulence in plasmas, a physical process thought to occur in many astrophysical phenomena.

[1]G. Gregori *et al.*, Nature 481, 480 (2012)
[2]J. Meinecke *et al.*, Nature Phys., accepted (2014)

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