



## Key Stage 5 – Table top supernova

### Turbulent amplification of magnetic fields in laboratory laser-produced shock waves

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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 nonlinear feedback process involving cosmic rays. The origin of the large magnetic field in the interior of the remnant is less clear but it is presumably 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 before the supernova explosion. Here we investigate the possibility that turbulent amplification is induced when the outer shock overtakes dense clumps in the ambient medium. We report laboratory experiments that 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. The experiment also provides a laboratory example of magnetic field amplification by turbulence in plasmas, a physical process thought to occur in many astrophysical phenomena.