

COSMOLOGICAL MAGNETIC FIELDS AND PARTICLE ACCELERATION IN THE LABORATORY

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Turbulence and magnetic fields are ubiquitous in the Universe. While magnetic fields are believed to play an important role during the evolution of the Universe and the generation of cosmic rays, their origin and present-day values still remain a mystery. Here we discuss the results of many laboratory experiments using high power lasers that have shed lights on the generation, amplification of the magnetic fields and the production of cosmic rays. We will present broad summary of work related to magnetic field produced by Weibel instabilities in collision-less shocks, by the Biermann battery at curved shocks, and by return currents. More recent experiments have also focussed on the amplification of these initial seeds by turbulent motions. Finally, we will discuss hypothetical mechanisms of magnetic field generation beyond the standard model and novel laboratory experiments using the next generation of laser facilities to test them.