Abstract Submitted
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How did the universe get magnetized?[1] MIKHAIL MEDVEDEV, Univ of Kansas — The origin of the micro-Gauss magnetic fields in the IGM of galaxy clusters is one of the outstanding problem in modern cosmology. We demonstrate that the cluster accretion shocks are naturally and inevitably generate sub-equipartition magnetic fields from scratch in a two-step process. Indeed, accretion shocks accelerate cosmic rays, which further generate magnetic fields via a streaming, Weibel-type plasma instability. We stress that no seed field is needed in this scenario. We develop a self-similar model of a cosmic-ray-modified foreshock and demonstrate that, in contrast to the conventional lore, the generated magnetic fields (i) are large-scale, i.e., can be of the order of the the shock curvature radius, tens of kpc or more, hence they are effectively decoupled from dissipation and hence are long-lived on the Hubble time and (ii) are strong enough, i.e., of the order of a fraction of the cosmic ray pressure, to meet observational constraints. We stress that no seed field is needed in this scenario, unlike other shock-related models of the field generation (e.g., via the Bell instability or the Richtmeyer-Meshkov vorticity instability).

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