Abstract Submitted
for the DPP14 Meeting of
The American Physical Society

Could the universe get magnetized by galaxy cluster accretion shocks?[1] MIKHAIL MEDVEDEV, University of Kansas — The origin of the micro-Gauss magnetic fields in galaxy clusters is one of the outstanding problem of modern cosmology. We propose that accretion shocks on galaxy clusters accelerate cosmic rays, which in turn are natural and inevitably generate magnetic fields from scratch via a streaming, Weibel-type plasma instability. We develop a self-similar model of a cosmic-ray-modifies foreshock and demonstrate that, in contrast to the conventional lore, the generated magnetic fields (i) are large-scale (of order the shock curvature radius, $\sim$ tens of kpc or more) hence they are effectively decoupled from dissipation and are long-lived on the Hubble time and (ii) are strong enough, of the order of a fraction of the cosmic ray pressure, to meet observational constraints. Unlike other shock-related models of the field generation (e.g., via the Bell instability or the Richtmeyer-Meshkov vorticity instability), our model does not require preexisting seed fields; the fields are generated in the intracluster at essentially a few cluster light-crossing times.

[1]Supported by grant DOE grant DE-FG02-07ER54940 and NSF grant AST-1209665.

Mikhail Medvedev
Univ of Kansas

Date submitted: 10 Jul 2014 Electronic form version 1.4