APR08-2007-000080

Abstract for an Invited Paper
for the APR08 Meeting of
the American Physical Society

Galaxies, SMBHs, Magnetic AGNs, and Extra Galactic CR formation.[1]

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The Brightest Matter, the Brightest Energy, the brightest quasi-star of the Universe (by very many orders of magnitude) is associated with the formation of the majority of the thin, flat rotation curve, spiral galaxies, each with a Super Massive Black Hole near their exact center. The transformation of the initial perturbation spectrum of the structure of the cooling baryonic fraction of the universe into a galaxy and finally into a SMBH is an awesomely complicated process. The further transformation of the free-energy of the formation of the SMBHs into magnetic fields, jets, Radio Lobes, and finally Extra Galactic Cosmic Rays, is even more complicated, each an irresistible physics challenge. A few such Examples: Initial structure perturbations have a small Reynolds number, $\sim$100. Computer simulations probably miss angular momentum transport in the collapse of proto galactic baryonic clouds to flat rotation curve galaxies. The seed BH at its center is probably preceded by a collapse mediated by pair neutrino emission, to a neutron star and a supernova. The unbinding of the supermassive star by the supernova is followed by fall-back and then by a black collapse until half the mass of the SMBH is accreted in a time of 1/20 the Eddington limit time. Only then can a Keplerian disk emerge. Event horizon physics dominates black collapse. The event horizon physics also dominates the $\alpha\omega$ dynamo that must precede the highly coherent helical magnetic jet formation. A coherent magnetic helix requires a large scale coherent dynamo. The dissipation of the current supporting the torsion-dominated helical magnetic fields probably occurs by current carrier starvation and resulting current carrier acceleration and momentum. The collimation and acceleration by magnetic fields occasionally leads to emission of $\sim$ 100 Mev gamma rays at $\sim$x100 the Eddington limit and probably CRs with E $> 10^{30}$ ev.

[1]Supported by the DOE
[2]with support by Nathan Currier and Hui Li