A galaxy's vortical inflow is driven by its luminosity and ability to deliver compound nuclei to its core. Once there, the composition of material entering the core is balanced against the rate of hydrogen leaving it.

Rewrite Equation (16.57), isolating efficiency as a function of temperature:

$$Q_g = \frac{\left(\frac{f_{cn}\varepsilon_U \text{v}_{\text{F-M}} c^4}{8GL_g}\right)\left(kT\ln\left(1+e^{\left(\frac{E_{s\vee}-E_{q\vee(T)}}{kT}\right)}\right)-E_{s\vee}+E_{q\vee(T)}\right)}{m_p c^2 - E_{s\vee}+E_{q\vee(T)}} \tag{16.58}$$

Using an estimated luminous output for the Milky Way of $1.4(10)^{37}$ W,⟨1.14⟩ a Strong veneer binder ($E_{s\vee}$) of 950 EV, a Weak veneer binder ($E_{w\vee}$) of 440 EV, and a Coulomb veneer binder defined by Equation (16.54), galactic efficiency is shown below as a function of veneer temperature for three different inflow compositions:

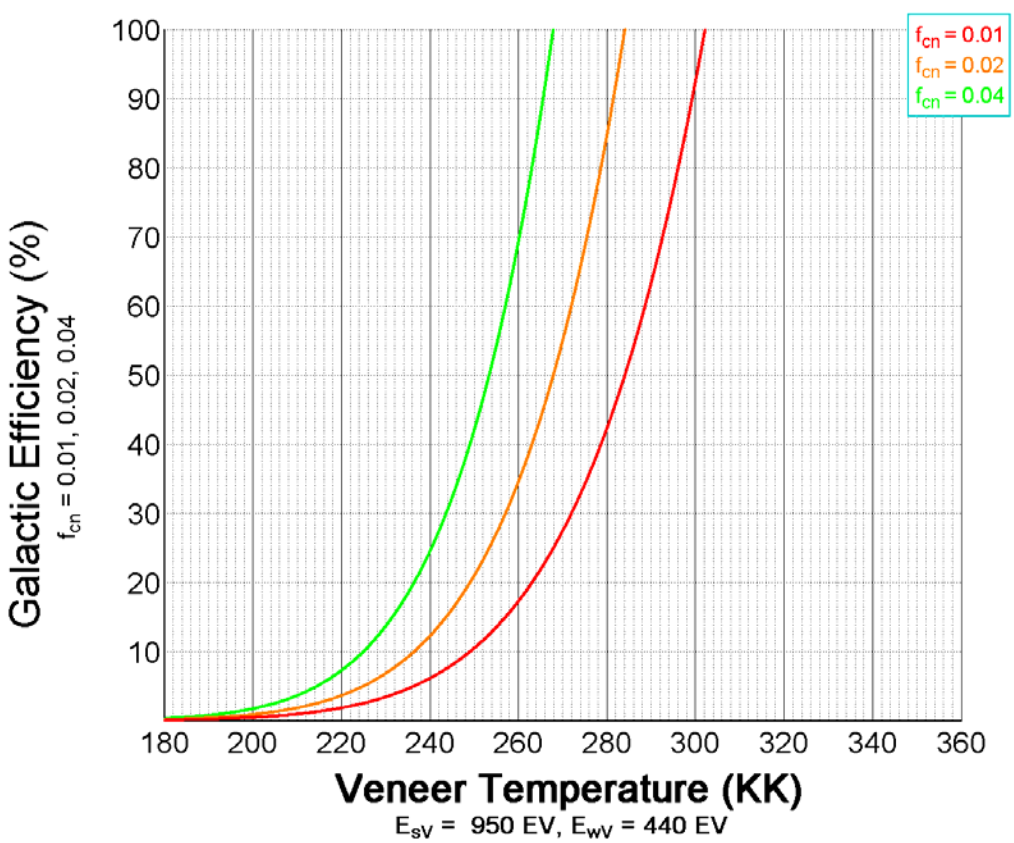

Figure (16.11) Galactic efficiency versus veneer temperature for core inflows of f_{cn} = 0.01, 0.02, 0.04

Compound nuclear fraction decreases from left to right. The green trace is 4% compound nuclei, 96% hydrogen. The red trace is 1% compound nuclei, 99% hydrogen. Both require over 250,000 °K to achieve nuclear disassociation at any appreciable efficiency. Even at an efficiency of only 10%, the temperature for any conceivable inflow composition is in excess of 220,000 °K. *The Milky Way's veneer is hot, but not blazingly hot.* Stellar cores are orders of magnitude hotter, consistent with the idea that heat is the agent of nuclear condensation while gravitational expansion drives nuclear dissociation.

The surface of the Milky Way's core is over 250,000 °K, yet with its enormous redshift, is virtually invisible in its violent ambient environment:

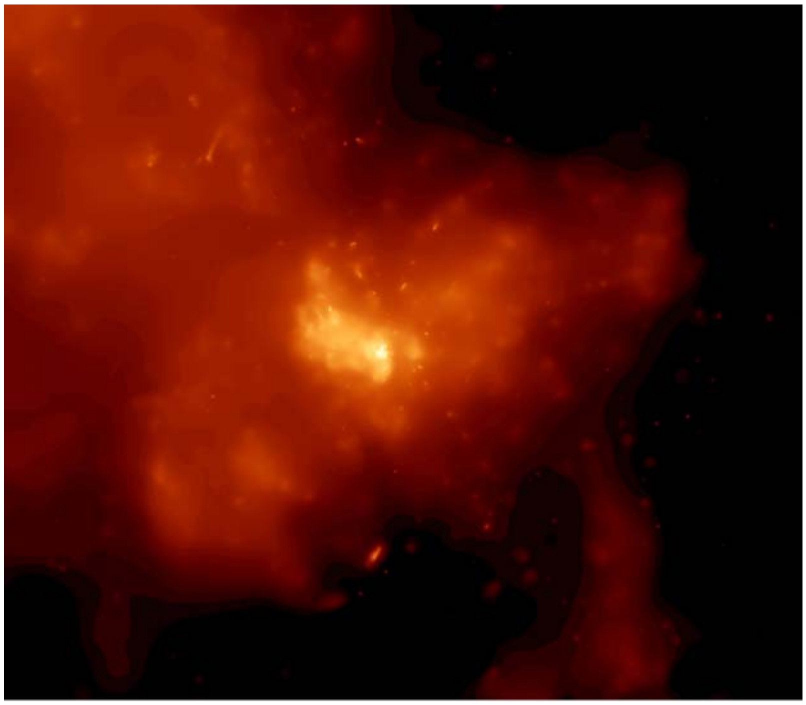

Figure (16.12) Core region of the Milky Way in long X-ray
(Courtesy NASA/CXC/MIT/F.K. Baganoff et al.)

Compound nuclear production is governed purely by a galaxy's luminosity, but the temperature required for nuclear dissolution is controlled by the material composition flowing into a galaxy's core. Since the compound nuclei a galaxy sends to its core are diluted by a high concentration of hydrogen, the only way it can keep pace with its own fusion is to move more material, and the only way to accomplish this is with a higher veneer temperature. That said, a galactic veneer's temperature response to input composition is fairly mild. It takes 268 KK to process a compound fraction of 0.04 at 100% efficiency. Yet a compound fraction twice as small, at 0.02, only raises veneer temperature 7% to 284 KK.

A galactic veneer's temperature is far more sensitive to binder values than compound nuclear fraction. Suppose, as a limiting case, that (a) the Weak binder has no effect on thermal electron migration and (b) protons' intrinsic binding energy is not reduced by the additional bound electrons in a neutral nuclear matrix. In this extreme scenario, veneer binders would be ($E_{s\vee}$ = 1100 EV) and ($E_{w\vee}$ = 0 EV), resulting in a core temperature of 0.57