Fig. 1.— A simple model of WHIM filaments converging to some critical radius $R$ of a cluster; at this radius the surface cover factor by the filaments reaches the maximum value of $f_0$ mentioned in the text. Each filament has length $L$, cross sectional area $A$, and is optically thin to soft X-rays.
\[ S(b) = \frac{2f_0n_e^2R^2}{b} \tan^{-1}\left( \frac{b}{\sqrt{R^2-b^2}} \right), \text{ for } b < R; \]

and \[ S(b) = \frac{f_0n_e^2\pi R^2}{b}, \text{ for } b \geq R \]

\[ M_{\text{WHIM}} = 4.25 \times 10^{14} \left( \frac{n_e}{10^{-3} \text{ cm}^{-3}} \right)^{-3} \left( \frac{f_0}{0.5} \right) \left( \frac{L}{5 \text{ Mpc}} \right) \left( \frac{R}{2 \text{ Mpc}} \right)^2 M_\odot \]
Fig. 3.— Intensity of the filament emission following the model of Section 3. The surface brightness has been multiplied by the average effective area $A_{eff} \approx 150 \text{ cm}^2$ of the PSPC instrument in the 1/4 keV band (R2 band, Snowden et al. 1998), in order to compare this detector-dependent intensity to the value measured by Bonamente et al. (2003) in the neighborhood of the Coma cluster (shown as the red dashed line).
Solid line is the expected emission spectrum of the hot ICM at $kT = 8.7 \pm 0.4$ keV and $A = 0.3$ solar, as measured by ASCA.
Central soft excess (no background issues) for Coma

Coma 0'-5' arcminute

![Graph showing normalized counts vs energy for Coma](image)
\[ p = \pi n a^2 \ell = 12 \left( \frac{n}{1.56 \times 10^{-4} \text{ Mpc}^{-3}} \right) \left( \frac{a}{0.5 \text{ Mpc}} \right)^2 \left( \frac{\ell}{1 \text{ Gpc}} \right) \% \]
\( \Omega_{b}^{\text{obs}} \) = mass density of observed baryonic (ordinary) matter

For the present-day universe \((z=0)\):

\[ \Omega_{b}^{\text{obs}} = \Omega_{\star} + \Omega_{\text{HI}} + \Omega_{\text{H}_2} + \Omega_{\text{X-rays}} \approx 0.0068 \]

\( \Omega_{b} \) = total mass density of baryonic matter

This is constrained by the observed abundance of primordial D from spectra of high \( z \) quasars:

\[ \Omega_{b} = 0.039 \pm 0.002 \ (H_0 = 70 \ \text{km s}^{-1} \text{Mpc}^{-1}) \]

\( \Omega_{m} \) = total mass density of all matter

\( \Omega_{\Lambda} \) = " " " " " energies \((E = mc^2)\)

shall present ample evidence for \( \Omega_{m} = 0.35 \pm 0.1 \), \( \Omega_{\Lambda} = 0.6 \pm 0.15 \)

so that:

- \( \Omega = 1 \), the universe is flat
- \( \Omega_{m} = 10 \Omega_{b} \Rightarrow \) dark matter
- \( \Omega_{\Lambda} > 0 \Rightarrow \) cosmological constant