$$t_{cool} \equiv \frac{E}{\dot{E}} \sim \frac{\frac{3}{2} n k_B T}{\Lambda(T)}$$

$$t_{dyn} \sim \frac{R}{2} \left[\frac{2GM}{R^3}\right]^{-1/2}$$

$$t_{cool} \sim 8 \times 10^6 \text{ yr} \left(\frac{n}{1 \text{ cm}^{-3}}\right)^{-1} \cdot$$

$$\cdot \left[\left(\frac{T}{10^6 K}\right)^{-1/2} + 1.5 f_m \left(\frac{T}{10^6}\right)^{-3/2} - 1\right]$$

↳ Bremsstrahlung (f-f) — lines (f-b, b-b)

f_m

$f_m \sim 1$ primordial, no metals

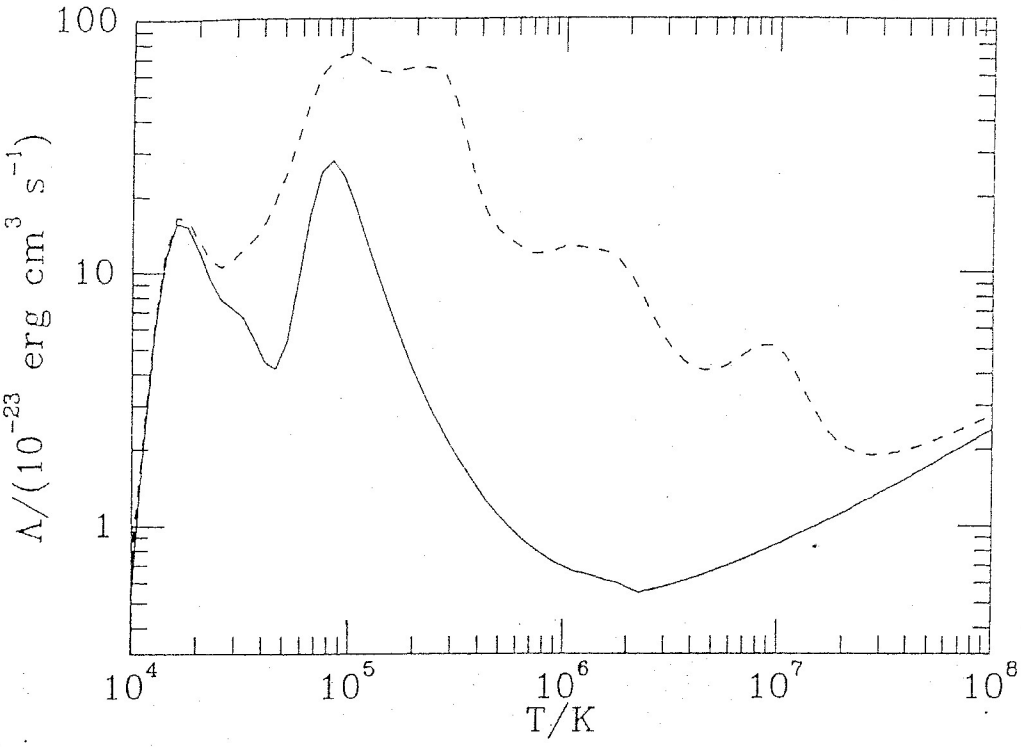
$f_m \sim 30$ solar abundance

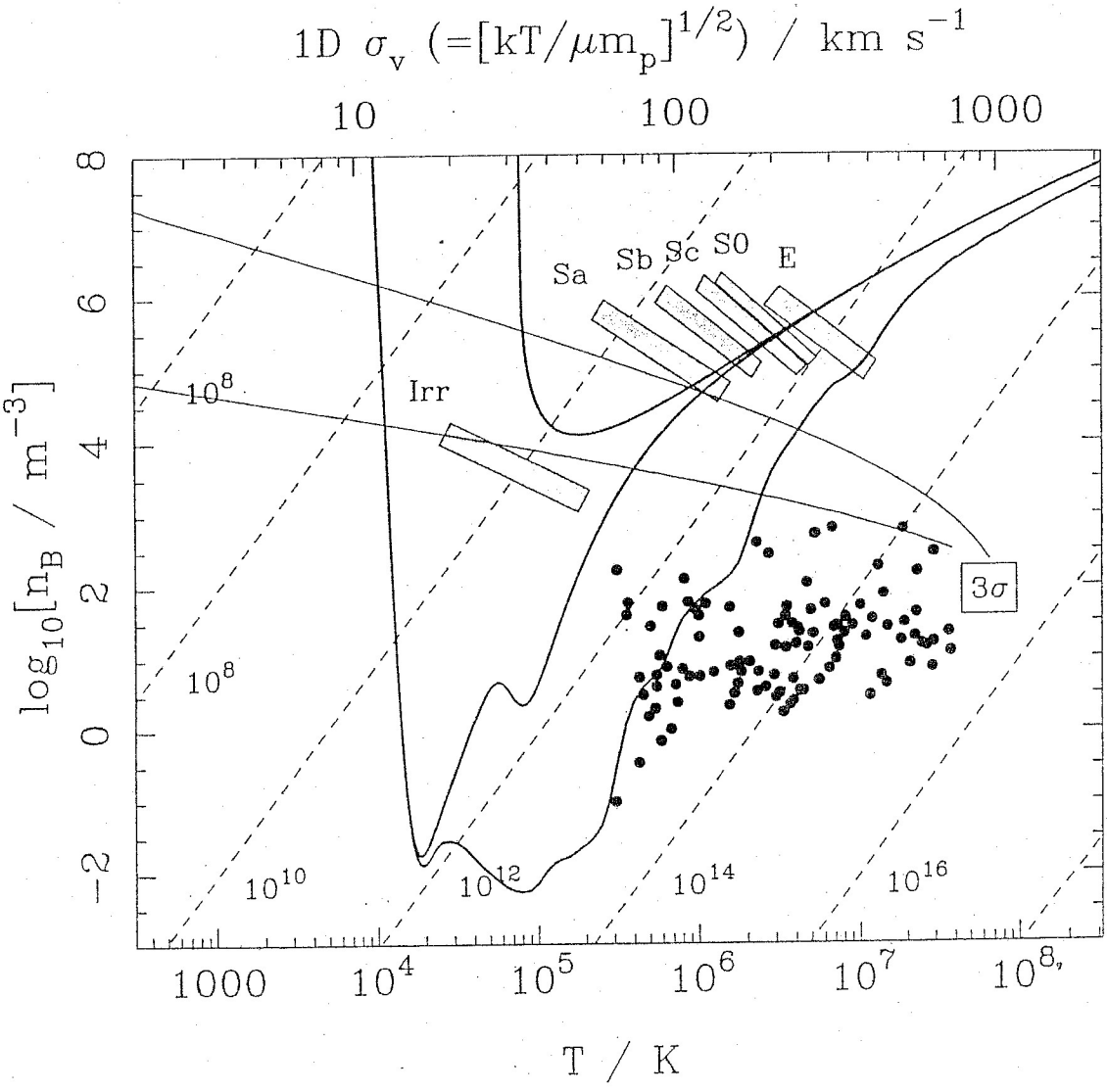
For $T < 10^6$, $f = 1$, $\mu = 0.57$

$$\tau = \frac{t_{cool}}{t_{dyn}} \sim \frac{M}{9 \times 10^{11} M_\odot}$$

$$M_{gal} \lesssim 10^{12} M_\odot \quad \Big| \; \tau \sim 1 \rightarrow R \sim 80 \text{ kpc}$$

↑ total mass


100
10
1
$\Lambda/(10^{-23}$ erg cm^3 s^{-1})
10^4
10^5
10^6
10^7
10^8
T/K


1D σ_v (=[kT/μm$_p$]$^{1/2}$) / km s^{-1}
10
100
1000
8
6
4
2
0
−2
$\log_{10}$[n_B / m^{-3}]
Sa
Sb
Sc
S0
E
Irr
10^8
10^8
10^{10}
10^{12}
10^{14}
10^{16}
3σ
1000
10^4
10^5
10^6
10^7
10^8
T / K