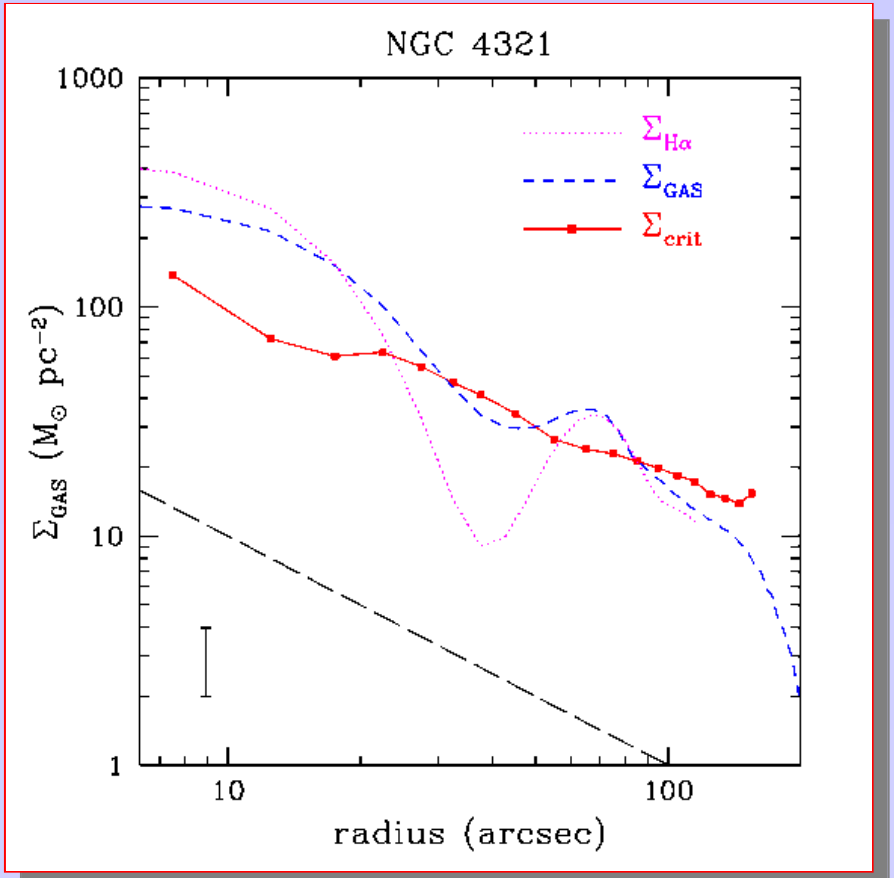
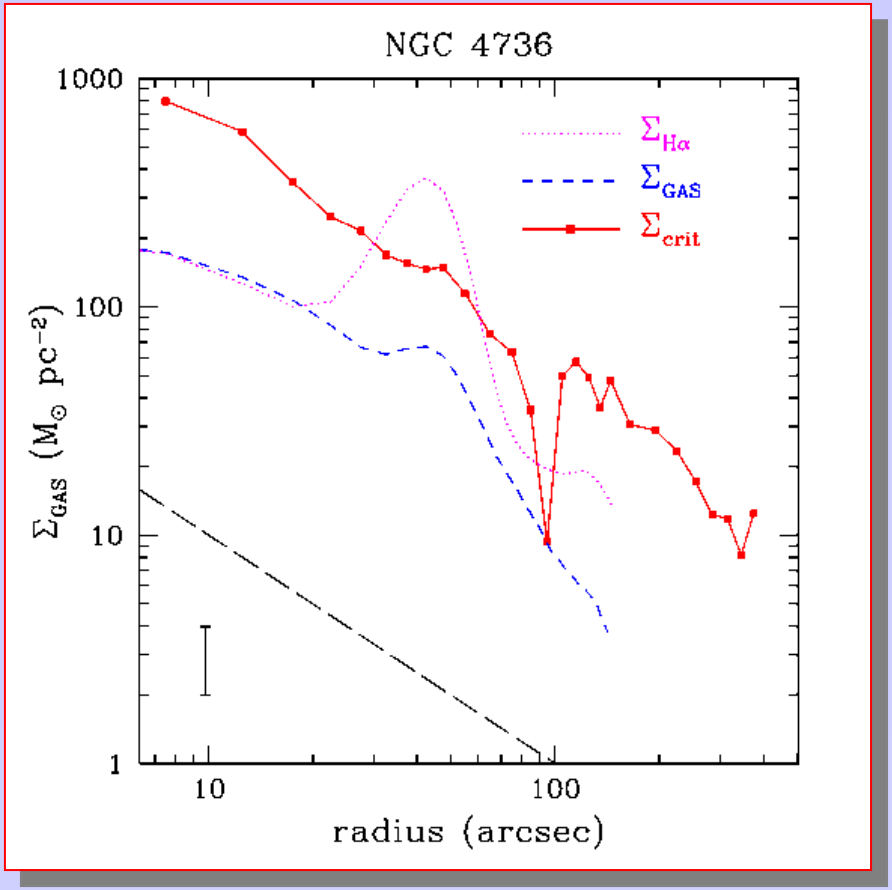
Radial instability of the gas layer





Wong & Blitz 2002

Why is Q_g (i.e. $\Sigma_{crit}/\Sigma_{tot}$) near unity?

$$V_c^2 = 2\pi G \Sigma_{tot} R$$

$$\Sigma_{tot} = \frac{\Omega V_c}{2\pi G}$$

For a Mestel disk with a flat rotation curve

$$\Sigma_{crit} = \frac{\sqrt{2}\,\Omega c_g}{\pi G}$$

For flat rotation curve

$$\mu Q_g = \frac{\Sigma_{crit}}{\Sigma_{tot}} = \frac{2\sqrt{2}\,c_g}{V_g}$$

For $\mu = \frac{\Sigma_{gas}}{\Sigma_{tot}}$

$$Q_g = \frac{2.8 c_g}{\mu V_c}$$

$C_g \sim 7$ km s^{-1}; $V_c \sim 200$ km s^{-1}; $\mu \sim 0.1$ ⟶ $Q_g \sim 1$

Based on Wong & Blitz 2002