**Gravitational collapse of a cloud of matter**

A cloud will collapse if it's bigger than a certain radius. This radius is called the Jeans radius and is the radius at where the gravitational force making the cloud collapse is exactly as powerful as the thermal force of the material wanting to push the cloud outwards:

$$\frac{3}{5}\frac{GM^2}{R} = \frac{3}{2}NkT$$

$$\frac{M^2}{R} = \frac{5}{2}\frac{NkT}{G}$$

We can write N as $\frac{M}{m}$ which gives the following formula:

$$\frac{M}{M} = \frac{5}{2}\frac{kT}{mG}$$

Next we write M as $\rho \cdot V$, giving us:

$$\frac{\frac{4\pi}{3}R^3\rho}{R} = \frac{5kT}{2mG}$$

$$R^2 = \frac{15kT}{8\pi mG\rho}$$

$$R = \sqrt{\frac{15}{8\pi}\frac{kT}{mG\rho}}$$

**Legend:**
**M: the mass of the entire cloud.**
**m: the mass of $H_2$**
**k: Boltzmann constant** $= 1.38 \cdot 10^{-23}\, J/K$
**G: gravitational constant** $= 6.673 \cdot 10^{-11} Nm^2/kg^2$
**T: the temperature of the cloud.**