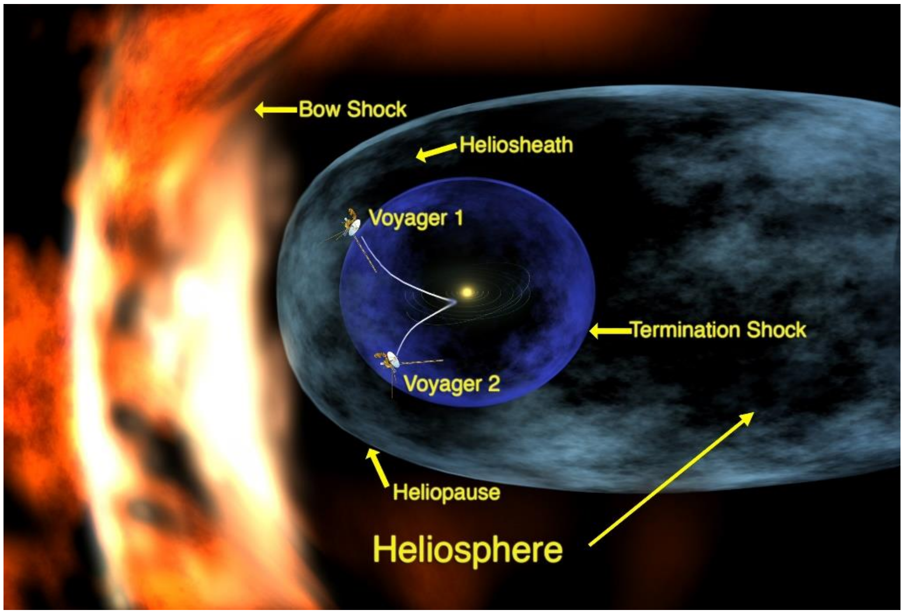
speed could reach up to 800 $km\ s^{-1}$. Heliosphere is not symmetry because of the relative motion of the solar system.



Eq. (4) could be applied to planets like Earth and we could end up with getting a mass outflow. But Earth has a magnetic field which could hold the particles (When particles reach to the upper atmosphere it becomes ionized due to the solar radiation thus would be subjected to the Earth's magnetic field). Planets like Mars have no magnetic field, thus have a mass outflow.

Solar Wind

Considering spherical symmetric stationary yet not a static system,

Continuity Eq.

$$\frac{\partial}{\partial r}(\rho v r^2) = 0 \rightarrow (1), \qquad \rho v r^2 = constant$$

Momentum Eq.

$$\rho v \frac{\partial v}{\partial r} = -\frac{GM_O \rho}{r^2} - \frac{\partial P}{\partial r} \rightarrow (2)$$

Gas law

$$P = \rho c_s^2 \rightarrow (3)$$

From Eq. (1) (continuity Eq.)

$$v r^2 \frac{\partial \rho}{\partial r} + \rho r^2 \frac{\partial v}{\partial r} + 2\rho v r = 0$$

$\div\ \rho v r^2 \Rightarrow$

$$\frac{1}{\rho}\frac{\partial\rho}{\partial r}+\frac{1}{v}\frac{\partial v}{\partial r}+\frac{2}{r}=0\rightarrow(4)$$

From eq. (2) (momentum eq.) and Eq. (3) (Gas Law)

$$v\frac{\partial v}{\partial r}=-\frac{GM_O}{r^2}-\frac{c_s^2}{\rho}\frac{\partial\rho}{\partial r}$$

$$\frac{v}{c_s^2}\frac{\partial v}{\partial r}=-\frac{GM_O}{c_s^2r^2}-\frac{1}{\rho}\frac{\partial\rho}{\partial r}\rightarrow(5)$$

From Eq. (4) and (5),

$$\left[\frac{v}{c_s^2}-\frac{1}{v}\right]\frac{\partial v}{\partial r}=-\frac{GM_O}{c_s^2r^2}+\frac{2}{r}\rightarrow(6)$$

At the critical radius ($r=r_c$) in eq. (6) L.H.S. = 0,

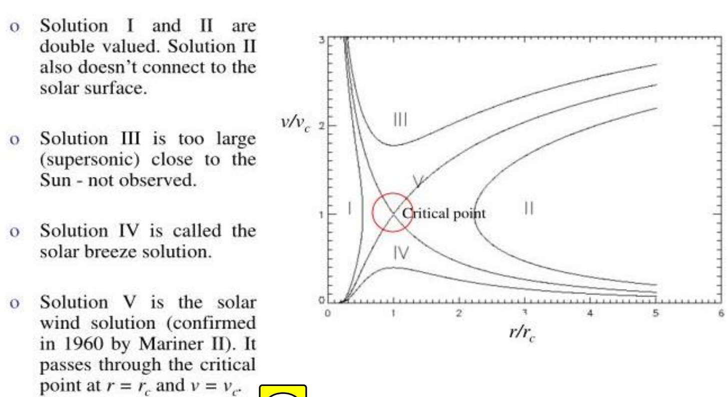
$$r_c=\frac{GM_O}{2c_s^2}\rightarrow(7)$$

By integrating Eq. (6) we can obtain the solution for the Solar Wind

$$\frac{v^2}{2c_s^2}-\ln(v)=\frac{GM_O}{c_s^2r}+2\ln(r)+constant$$

The solution is independent of the sign of v, so we could rearrange the eq. as follows

$$\frac{v^2}{2c_s^2}-\frac{1}{2}\ln(v^2)=\frac{GM_O}{c_s^2r}+2\ln(r)+constant\rightarrow(8)$$



Eq. could also be used to describe a mass inflow for a star which will be mirror image across x-axis of the above graph. That show the mass inflow at a star formation.