

Solar wind exercise

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For a steady-state, spherically symmetric freely expanding solar wind, conservation of mass and momentum give:

$$4\pi r^2 n v = K_1$$

$$4\pi r^2 n v^2 = K_2$$

which give:

$$v = \text{const.}$$

$$n \propto r^{-2}$$

Therefore we want to fit a power law

$$n = \alpha r^\beta$$

taking the logarithm we have

$$\ln n = \ln \alpha + \beta \ln r$$

so we have to perform our **linear** regression

$$y' = a_0 + a_1 x'$$

on the variable y' and x' defined as

$$y' = \ln n$$

$$x' = \ln r$$

The fitting parameters are linked to the power law parameters by:

$$\beta = a_1$$

$$\alpha = e^{a_0}$$