A note about Fig. 3 in Jenkins (1994)

Definition of the equivalent width

\[ W_\lambda = \int [1 - e^{-\tau(\lambda)}] d\lambda; \]  
(1)

\[ \tau(\lambda) = \frac{\pi e^2}{m_e c^2} f \lambda^3 N(\lambda); \]  
(2)

\[ N(\text{cm}^{-2}) = 1.13 \times 10^{15} \frac{W_\lambda (\text{mÅ})}{f \lambda^3 (\text{Å})} \quad (\tau(\lambda) \ll 1), \]  
(3)

where \( \lambda \) is the rest wavelength of the line and \( f \) is its oscillator strength. In Equation 1, \( W_\lambda \) measures the amount of energy removed by the absorption and is independent of the instrumental resolution. When a line has well-developed damping wings, the following equation may be used to relate \( W_\lambda \) and \( N \) on the square root portion of the curve of growth:

\[ N(\text{cm}^{-2}) = \frac{m_e c^3}{e^2 \lambda^4 f} W_\lambda^2 = 1.07 \times 10^{33} \frac{W_\lambda^2 (\text{mÅ})}{f \gamma \lambda^4 (\text{Å})} \quad (\tau(\lambda) \gg 1), \]  
(4)

where \( \gamma \) is the radiation damping constant. In practice, \( N \) is generally estimated in this regime through a continuum reconstruction (Bohlin 1975; Dipals & Savage 1994) since the width of the line is usually much larger than the width of the instrumental spread function (i.e. the line is resolved). The H I Ly\( \alpha \) line at 1215.67 Å is the most common example of a damped line in the G H R S wavelength range, but in a few cases some strong metal lines (e.g. Mg II \( \lambda \lambda 2796, 2803 \)) may also have damping wings (Sofia et al 1994).

- You might want to use this figure in your project... (see bonus question today)
- If you do, you’ll need to convert the Cl I column density to an “equivalent width”
- This can be done with this equation from Savage & Sembach (1996)