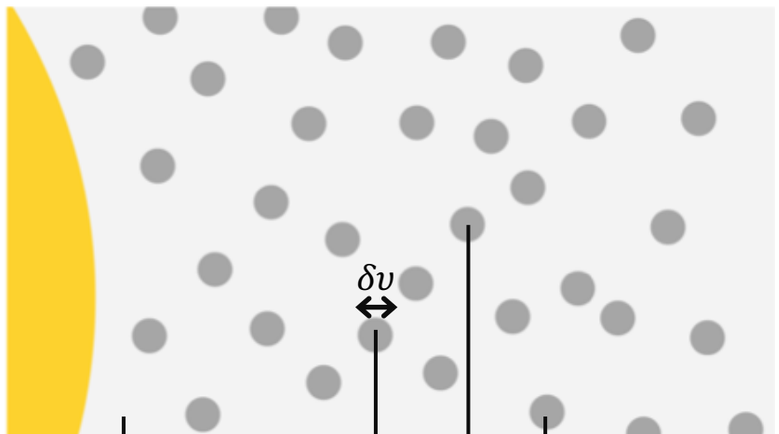
Clumped wind

Clumps can become optically thick, especially in strong resonance lines.



$\rho_{\rm ic}$
Density of the interclump medium. A denser medium will absorb more light.

$\rho_{\rm cl}$
Density of the clumps. Affects the ionization state.

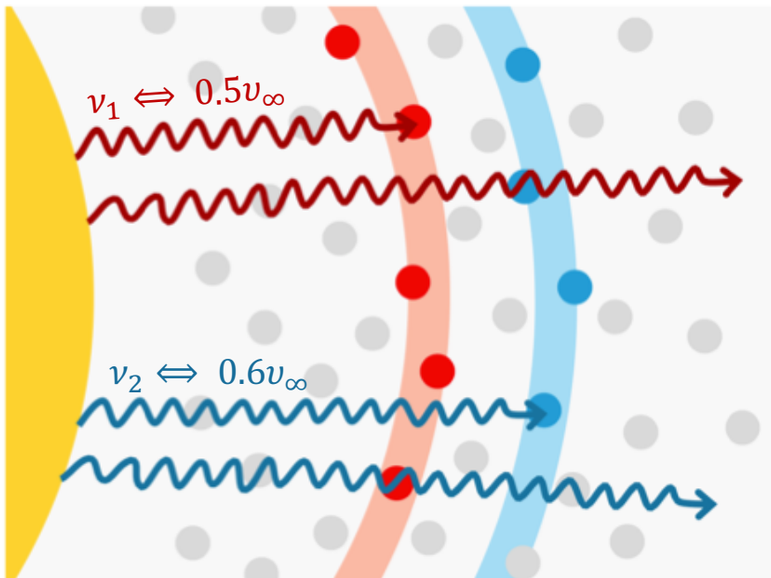
δv
The clumps span a certain velocity range δv, that can deviate from the underlying smooth field $\delta v_{\rm sm}$.

$f_{\rm vol}$
Fraction of the volume that is filled with clumps.

Velocity-porosity or "vorosity"

$(\delta v = \delta v_{\rm sm})$

The velocity span of the clumps δv follows the underlying smooth velocity field.



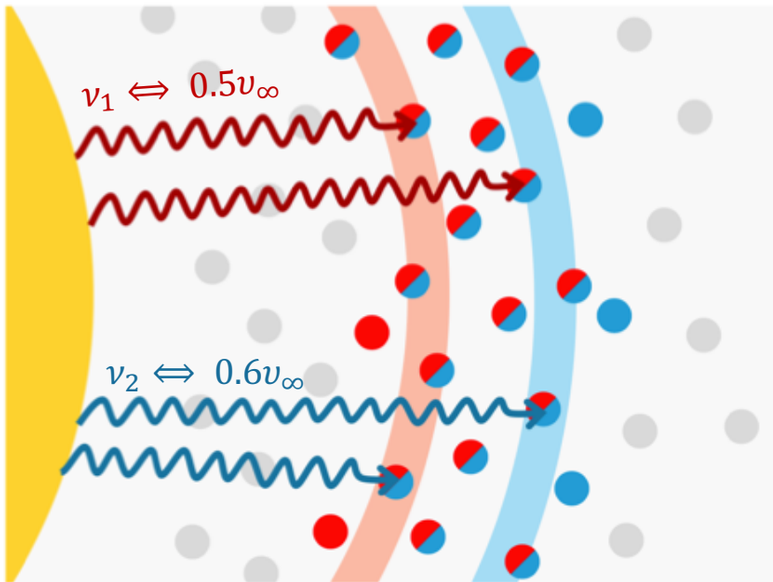
Optically thick clumps block some light, but as the medium is porous some light slips through.

If $\delta v/\delta v_{\rm sm} = 1$, then $f_{\rm vel}$ depends only on $f_{\rm vol}$:

$$f_{\rm vel} = \frac{f_{\rm vol}}{1 + f_{\rm vol}}.$$

$(\delta v \gg \delta v_{\rm sm})$

The velocity span of the clumps δv exceeds that of the underlying smooth velocity field.



The velocity-porosity effect is still there, but more light is blocked, as in velocity space the gaps between clumps are effectively closed.

If $\delta v/\delta v_{\rm sm} > 1$, then $f_{\rm vel}$ will increase:

$$f_{\rm vel} = \frac{f_{\rm vol}(\delta v/\delta v_{\rm sm})}{1 + f_{\rm vol}(\delta v/\delta v_{\rm sm})}.$$