Clumping in Hot Star Winds
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Multicomponent stellar wind of hot stars

V. Votruba[1,3], A. Feldmeier[2], J. Kubát[1] & D. Rätzel[1]
[1] *Astronomický ústav, AV ČR v.v.i., Czech Republic*
[2] *Universitat Potsdam, Germany* [3] *Masarykova univerzita, Czech Republic*

We developed a time-dependent multicomponent hydrodynamical code for simulation of the stellar wind from hot stars and applied it to stars with high and low density winds.

One of the major aproximations of the CAK theory is the one component fluid aproximation. This approximation is acceptable for most cases of stellar winds from O stars and some B stars. But in fact, the radiation is acting on absorbing ions and electrons only, and these particles share momentum through Coulomb collisions with the remaining passive part of the plasma (namely protons).

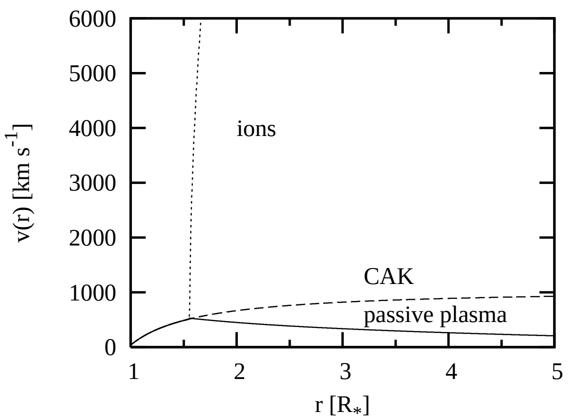

Figure 1: Final wind velocity laws for the model B5 after 55 flow time units R_*/v_∞. Absorbing ions are marked by $(\cdots)$, passive plasma by (—), and the result of the one-component code by (- - -).

Decoupling

The dynamical effect of the Coulomb collisions on plasma is well described by dynamical friction, which was first used by Chandrasekhar (1943) for the case of the gravity force, and later it was used for the electromagnetic force by Spitzer (1956). As was first shown by Springmann & Pauldrach (1992), this more detailed multicomponent description of a stellar wind predicts a runaway mechanism. This means that under certain conditions, namely low density of the wind, Coulomb interactions are so small that they stop the momentum transfer between the passive bulk of plasma and absorbing ions and, as a result, the wind decouples at a certain point. From this point, called the decoupling radius, absorbing ions are highly accelerated by radiation, while passive plasma is decelerated by gravity. We simulated the effect of decoupling for a model star B5, with stellar parameters from Krtička & Kubát (2000).

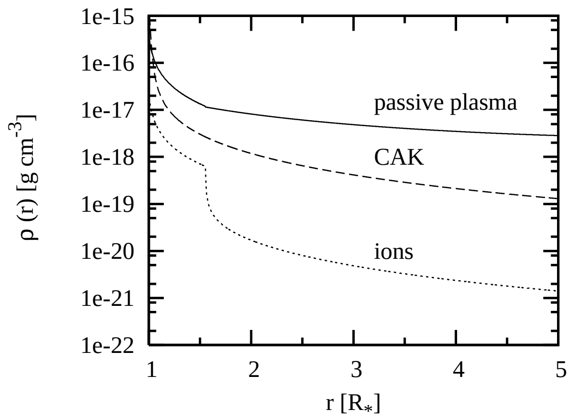

Figure 2: Wind density for the same model B5 star.

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