The collision of high speed wind against the high density gas ; Application of R-CIP method to an plasma astrophysical problem

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Just as the solar wind interacts with Earth's magnetic field, we may suppose that stellar winds from proto-stars interact with proto-planetary disks surrounding them. The gas composing the disk disappears with it growing. Nobody knows the mechanism. Is it possibility that stellar winds carry away the gas? It has been recognized that stellar wind is so weak that it is unable to react on the disk. But we consider that the stellar wind influence of wind on the disk may ignore if the wind cannot carry away the gas immediately. We would like to view in detail the interaction between stellar wind and the gas surrounding them.

In this study,we have modeled this process as a wind-dense gas collision process and studied how the shocks that emerge in the process behave by numerical simulations using R-CIP method. The robustness of the R-CIP method over huge dynamic ranges is the reason of adopting this method. In one-dimensional simulations, a supersonic flow collides with an obstacle made of dense gas. The density of the obstacle gas is set 10^2 - 10^6 times the wind's density. Crashing the wall,a shock breaks up and diverge some shocks. And the shocks make two shocks at last repeating to meet and to separate. The highest density cases have yet smaller density ratio than the actual situation we are interested in but show almost identical behavior. This result implies that an asymptotic state has been reached and that we may envisage what happens when a stellar wind collides at the inner-edge of a proto-planetary disk. The results from two-dimensional simulations will also be shown in this talk.