



## On limit of dedispersion algorithm: A new prospective on dispersion removal

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Dispersion is a phenomenon that widely exists in the observations of radio astronomy. It is introduced by the propagation properties of radio waves in the interstellar medium. In order to study the radiation properties of celestial bodies such as pulsars and FRBs, it is necessary to eliminate the influence of the interstellar medium. This process is called, dedispersion. As people pay more and more attention to transient phenomenon, how to better eliminate the influence of the interstellar medium and obtain more details of pulse profile has gradually become important, while larger telescopes have also made it possible to reach these details.

In order to realize the dispersion removal, many algorithms have been studied. It can be broadly divided into two categories, non-coherent dedispersion and coherent dedispersion. Incoherent dedispersion performs delay compensation on the power spectrum data according to the frequency. The algorithm is simple and used for a long time. There are many optimizations on computation for this principle. But this method cannot remove the dispersion in the bandpass. Coherent dedispersion partly solves this problem. By additionally compensating the dispersion in the bandpass, the influence of dispersion in the bandpass is reduced, and more pulse profile details can be restored. These methods all consider the dedispersion problem after channelization.

For the demands on higher time resolution, where are the limits of the dedispersion algorithm? How to reach these limits? This work discusses these issues, reconsiders the problem of dedispersion from raw voltage data before any kind of channelization. We discuss the limits of the ability of dedispersion algorithm, and proposes a method to achieve its limit. The characteristics of the method is described and proposed a flexible parallelization method for computing. These methods are verified in archived data.