# Fourier-domain excision of radio frequency interference

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The ever increasing radio frequency interference (RFI) often severely limits the potentially achievable sensitivity offered by a telescope. While many robust statistical approaches have been developed to excise primarily the RFI instances with spiky or burst-like characteristics, these techniques seem to have limited applications when the data are heavily affected by periodic RFIs. Contamination by periodic interference, such as by the well known 50/60 Hz power−line interference, changes the apparent nature of the underlying statistical distribution, making it hard to identify the outliers (see Figure 1). The situation is generally further complicated by the fact that periods of such terrestrial interferences often vary with time.

I will describe a technique that first identifies and excises the periodic interference in the Fourier-domain using reasonably high-resolution time-frequency data to restore the underlying statistics. The resultant data, which are now much more suitable for threshold-based filtering in the time-domain, are further subjected to several conventional RFI filtering techniques. The strengths and weaknesses of this method with respect to RFI mitigation will be discussed and illustrated with real examples. A particular application in pulsar searches will also be illustrated, wherein this method not only helps in achieving desired sensitivity but also significantly reduces the number of pulsar candidates that one has to generally sift through. The technique has already helped in confirming an intriguing but very hard to detect pulsar candidate using the upgraded giant metrewave radio telescope (uGMRT).

With the highly sensitive contemporary as well as upcoming radio telescopes, like FAST, SKA, uGMRT, etc., RFI remains a growing concern. The above Fourier-domain RFI excision, followed by other robust statistical approaches, will help us in achieving the designed sensitivity of these telescopes.
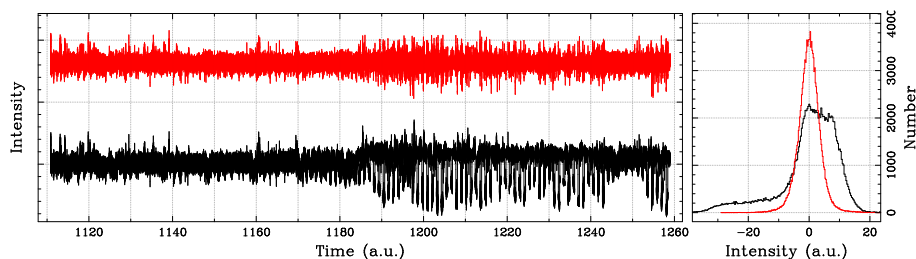


**Figure 1.** The left panel shows examples of a time-series contaminated by periodic RFI (black) and the time-series after RFI excision (red). The panel on the right side shows the corresponding intensity distributions for the two time series in the left panel. Clearly, the underlying Gaussian distribution (red) which was completely distorted in the original data (black) is recovered after RFI excision.