

Research Progress of RFI Mitigation on FAST

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The Five-hundred-meter Aperture Spherical radio Telescope (FAST) passed its national acceptance on 2020 January 11. It operates at frequencies ranging from 70 to 3000MHz and is the most sensitive single-dish telescope in this frequency range[1]. This makes it more vulnerable to radio frequency interference (RFI) from active services, and RFI mitigation becomes indispensable in observation and data processing.

Thanks to the radio quiet zones around FAST and measures of Electromagnetic Compatibility (EMC), RFI from terrestrial transmitters and the telescope itself have been mitigated effectively. Furthermore, a satellite RFI monitoring system and database have been constructed and installed at the FAST site to assess the satellite RFI over FAST sky coverage.

Meanwhile, some pre-correlation and post-correlation techniques are proposed to mitigate RFI in baseband or correlated data. Such as Spectral Kurtosis (SK) threshold method, spatial filter based on the multi-beam cross-correlation, and RFI classifier with Principal Component Analysis (PCA). The SK threshold method is a real-time pre-correlation technique, which labels the contaminated frequency channel in baseband. Spatial filters use the relative arrival times of a signal at multiple sensors to identify and separate signals from different directions[2]. The effectiveness of the technique was tested using the J0528+2200 pulsar data, and the results show that the spatial filter can mitigate the RFI effectively especially the satellite RFI. The RFI classifier using the PCA to extract the main components corresponding to the RFI portions from the signal. After that, using the time and frequency characteristic to classify the component. This method has been successfully applied to the HI data and extracted some RFI that hasn't been found before.

For future work, we will continue to optimize the RFI mitigation techniques in observation and data processing. And an RFI database is being established to guide observational procedures and RFI mitigation strategies.

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References

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