48th IAA SYMPOSIUM ON THE SEARCH FOR EXTRATERRESTRIAL INTELLIGENCE (SETI) – The Next Steps (A4)
SETI 1: SETI Science and Technology (1)

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AUTOCORRELATION-BASED DETECTION METHODS FOR ASTROPHYSICAL AND INTERSTELLAR COMMUNICATION SIGNALS

Abstract

The detection and reconstruction of potentially weak Signals-Of-Interest (SOI) in presence of noise is an important challenge in interstellar communication and astrophysics. The standard signal detection methods are based on energy or statistical variations in the time and frequency domains. The exploitation of the signal autocorrelation function, despite its higher computational complexity, is an interesting alternative to recover weak signals.

The Karhunen-Loeve Transform (KLT), for instance, statistically decomposes the signal into its main *auto-correlated* components, and allows their optimum extraction. As such, the KLT is an ideal operator for performing blind adaptive filtering. For that reason, the KLT has triggered an increasing interest in the astronomical community, although no applicability, nor detection and extraction performance analyses have yet been published in the astronomical context.

We propose a new KLT method based on a variant of the autocorrelation matrix. We first studied the reconstruction performance of the method via Monte Carlo simulations for different types of SOI. Secondly, a detection performance analysis of the method has been done, and we have compared the proposed approach with standard detection techniques.

The results of these analyses, as well as the demonstration of the methods on real astronomical data, will be reported in this talk.