TECHNICAL RFI MITIGATION AND SPECTRUM MANAGEMENT

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Considerable interest and development work on technical solutions to RFI mitigation have been generated in recent years by the radio astronomy community. This adds a new dynamic to the spectrum management process. Radio astronomers have an obligation to employ modern signal processing methods for sharing the spectrum with active services, but everyone must be aware that these methods add to the hardware, software, telescope time, and data analysis effort costs of astronomy research. Also, there are practical limits to which made-made signals can be separated from weak cosmic radiation.

This presentation gives a brief overview of the current state of the art of technical RFI mitigation in radio astronomy. Part of the theoretical framework for unwanted signal cancellation from the electrical and acoustics engineering community is now about 30 years old. Through simulations and a bit of practical prototyping radio astronomers are beginning to understand the weak-signal domain limits of these techniques, and they have extended the mathematical framework into post-correlation signal processing. Pre- and post-correlation canceling methods usually have direct analogs of one another, but there are advantages of signal processing cost and ability to follow rapidly changing interference on both sides of the ledger. Straightforward time blanking techniques work well on low-duty-cycle signals, such as pulsed radar and distance measuring equipment. Foreknowledge of the signal characteristics very often adds to the efficacy of RFI excision, and some types of man-made signals are easier to distinguish from cosmic radiation than others. There is room for negotiations on this point in the spectrum management process.

Because of the added resources required for technical RFI mitigation the new techniques are only very slowly finding there way into practical use. RFI simply makes some types of research too expensive, and this science will be economically out of reach. It is clear that interference-free spectrum allocations for passive radio science are still very much required and will continue to be for the foreseeable future. However, there are a number of interesting opportunities for spectrum sharing to the advantage of both active and passive user of the spectrum that are being opened up by the falling cost of signal processing hardware. Smart radios can use spectrum more efficiently for communications. They can also be aware of radio quiet preserves in the complex time, frequency, and geographic space in an adaptive manner, partly driven by individual observatory spectrum usage patterns.

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