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Maintaining Access to Spectrum for Astronomy and Passive Radio Science

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Abstract: Overproduction and misdirection of artificial radiation harm the environment, degrade our experience of Nature, and erode scientific access across the electromagnetic spectrum. Astronomers and non-astronomers, amateur and professional astronomers, optical and radio astronomers, and radio astronomers and remote-sensing scientists now meet regularly to air problems created by overproduced/misdirected artificial radiation, and work toward shared solutions for disciplines that formerly saw themselves as having little in common.

Radio astronomy has historically (60+ years) been viewed as protected by spectrum management and regulation. Frequency allocations to radio astronomy below 80 GHz are slight (fractionally a few percent) and some are persistently violated (i.e., Iridium at 1612 MHz), but the $\lambda = 21\text{cm}$ HI line was protected, and spectrum allocated to active services was little used and readily accessible.

This arrangement is under stress as mobile phones and mobile transmitters proliferate, and airborne and space-borne broadband radiocommunication systems like satellite internet, HAPS (high altitude platform systems), HIBS (high altitude cell phone base stations), and air-air mesh networks are deployed. The sky and the spectrum are filling in and even vacant radio spectrum will increasingly be found in the immediate spectral vicinity of strong radiocommunication signals that are observed with appreciable telescope gain.

Especially concerning now is that the number of satellites in low earth orbit has increased by a factor ten in three years, will double in two-three years, and could increase ten or more times again in a decade. New satellites are unexpectedly bright optically in reflected sunlight, causing the remarkable convergence of interest among environmentalists, dark-sky lovers, optical and radio astronomers and others noted in the summary. The radio spectrum regulators that register and authorize satellites have inadvertently become gatekeepers to sky and spectrum in ways that far exceed their mandate to protect radio spectrum bands. The FCC was allowed to exempt satellites from consideration under the National Environmental Policy Act (NEPA) in 1986 and has never revisited that decision.

In this talk recent developments in spectrum management for radio astronomy will be described and the discussion will be broadened to summarize the many interactions that radio astronomers have recently had with other spectrum users outside their normal orbit.



Biography: Harvey Liszt is an astronomer and the spectrum manager at the National Radio Astronomy Observatory (NRAO) in Charlottesville, Virginia. He is the current chair of IUCAF: The Scientific Committee on Frequency Allocations for Radio Astronomy and Space Science. In his 40-odd years at NRAO he was the Green Bank Telescope (GBT) Project Scientist and the technical advisor to the team of lawyers that successfully defended NRAO in the years-long arbitration suit brought by the companies that constructed the GBT. He spent the late 1980s programming drawspec and other spectral line data reduction software on PCs. His scientific interests include the structure of the Milky Way and the Galactic Center, and the chemistry of diffuse gas in the interstellar medium.