Building a radio telescope with which to observe radio emissions from Jupiter in the form of S- and L-bursts

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Radio emissions from Jupiter were first discovered in 1955 by Bernard Burke and Kenneth Franklin, and patterns in the emission observed by James Warwick and George Dulk in 1960s Boulder, Colorado. These patterns were later confirmed by NASA's Voyager missions.

The source of these emissions is Jupiter's magnetosphere, which creates "radio lasers" made up of magnetised plasma moving at high velocities towards Jupiter's poles, producing the bursts of radio emissions that Burke and Franklin first discovered. They found that these bursts corresponded with Jupiter's rotation and came in either long bursts (L) or short bursts (S).

Various aspects can influence the character of these emissions, such as the orientation and thermal emission of Jupiter, but Jupiter's moon Io has the most prominent impact. The moon's volcanic properties has the effect of creating the "Io torus", an electrically conducting ring of electrons, sulphur & oxygen ions around the planet, from the ionization of volcanic gases The movement of Io through the Io torus also creates a high electrical current flow between Io and Jupiter. This disturbance of Jupiter's magnetic field by Io triggers the emission of Decameter radio waves (waves measured in tens of metres). There is also an inner belt of radiation (10 MeV electrons) that gives rise to Decimetric radio emissions (waves within the range of centimetres in length) as electrons are gyrate around Jupiter's strong magnetic field in what is called "sychrotron radiation".

The Decametric waves can be detected in L- or S-bursts by constructing a simple radio telescope composed of two dipoles in a dual array system. By building a receiver and antenna with specifications unique to your observing latitude and time of year, Jupiter emissions can be recorded and converted into audio. With each burst type having a distinct sound (L-bursts like breaking ocean waves and S-bursts like crackling or popping) they can be identified and distinguished from each other by analyse of recorded audio. Emission patterns observed from a Jupiter radio storm can then be compared to see if they are consistent with predictions made based on Io's phase, as well as analysed against data from other observers, such as different radio telescopes across the globe or potentially even spacecraft.

This project aims to build such a telescope which can then be used to detect these emissions during Jupiter's Observing Season.