

APPLICATION OF RADIO PHASE MODES TO MODIFICATION AND REMOTE SENSING OF THE ATMOSPHERE AND SPACE

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Radio phase modes are a low-frequency electromagnetic manifestation of photon orbital angular momentum (OAM) modes. At optical (laser) wavelengths OAM is an active area of theoretical and experimental research. Theory and modelling of radio phase modes show they may also easily be generated and, under certain conditions, detected with modern radio antenna arrays. Transmission of radio phase modes has and is been attempted using the HAARP HF transmitter in Alaska and the Jicamarca VHF radar in Peru. The HAARP experiment is designed to search for possible artificial plasma modification effects of high-power radio phase modes transmitted into the auroral ionosphere, while the Jicamarca experiment is exploring the possibility of using radio phase modes for radar remote sensing of the equatorial electrojet, both of which are turbulent space plasma environments. Further work at Jicamarca will be aimed at verifying phase mode transmission and detection capabilities, perhaps by using the moon, or an aircraft, as a reflector. Other potential applications of phase modes include the detection of radio OAM generated by astrophysical sources, and the use of radio OAM “polarization” channels in communications as a way of transmitting multiple signals at a single frequency.