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# OPTIMIZING LUNAR FAR-SIDE BASED RADIO ASTRONOMY: NEXT-GENERATION SEISMICALLY COMPENSATED RADIO TELESCOPE WITH ADAPTIVE CALIBRATION FOR ENHANCED OBSERVATIONS

**Abstract**

The far side of the moon offers an exceptional environment for radio observations due to minimal interference, however, in the pursuit of advancing lunar radio astronomy through the far side of the moon, the Lunar Crater Radio Telescope (LCRT) and similar missions face a formidable obstacle in the form of moonquakes on the far side of the moon. This paper presents an innovative solution to this challenge- SCRT: A Seismically Compensated (modular) Radio Telescope. Deployable on various lunar landers, this device combines the capabilities of a modular radio telescope with a lunar seismometer, offering a dual-purpose instrument for far-radio wave observations. The integration of a seismometer within the device is crucial for addressing the impact of moonquakes on the observational data accuracy. By detecting and recording seismic activity on the lunar surface, the system gathers valuable data to calculate a dynamic calibration factor specific to each moonquake event. The calibration factor is continuously refined through an adaptive algorithm, incorporating machine learning predictive models. This real-time adjustment capability allows the system to anticipate and predict moonquakes, ensuring optimal data accuracy during radio observations. The versatility of the integrated device, compatible with various lunar landers, facilitates data collection from diverse lunar surface locations. The collected data forms a comprehensive database, proving valuable for future missions such as the LCRT. The adaptive calibration factor emerges as a critical asset, providing resilience against moonquakes and enhancing the reliability of far radio wave observations. This not only addresses the challenges posed by moonquakes to far-radio observations but also establishes a foundation for a more comprehensive understanding of the lunar surface and its behaviour. The adaptive nature of the instrument, coupled with its compatibility with different lunar landers, promises to save substantial time and scientific efforts in future lunar missions, contributing to the advancement of far-side radio astronomy. This paper explores the imperative need for resilient far-radio wave observations in the face of moonquakes, detailing the innovative design and algorithms employed in the development of the Integrated Modular Radio Telescope and Seismometer for comprehensive lunar surface exploration.