Harnessing Multi-User Virtual Reality Collaboration to Address Challenges in Multi-Messenger and Multi-Wavelength Transients Across BRICS Nations.

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Abstract

The exploration of Multi-Messenger and Multi-Wavelength Transients (MMMWT) including phenomena such as neutron star mergers and black hole collisions has revolutionized astrophysics, requiring highly coordinated data integration across diverse observational channels; electromagnetic waves, gravitational waves, and neutrinos. However, BRICS countries face critical challenges in responding to these complex, fast-evolving events. This abstract proposes the development and implementation of a Multi-User Immersive Virtual Reality (VR) Collaboration Platform tailored for BRICS-based research institutions to collectively investigate MMMWT phenomena. The platform aims to create an interactive, shared 3D environment where astronomers, engineers, physicists, and data scientists can visualize complex multi-source data, simulate transient scenarios, and co-develop models and strategies in real time. Through avatar-based interaction and synchronized toolsets, users can collaboratively analyse data streams from radio, optical, and gravitational observatories, overcoming geographical and disciplinary barriers. The aim of this approach is to facilitate transdisciplinary problem-solving and accelerate coordinated decision-making during transient events. Multi-user VR collaboration offers immersive spatial representation of high-dimensional datasets, enabling intuitive pattern recognition, enhanced knowledge transfer, and democratic engagement between institutions with diverse capacities. For BRICS countries, this model could also strengthen scientific diplomacy, promote shared capacity building, and support equitable participation in frontier astronomy.