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Delving Beyond the Missing Pages in the Story of the Universe with the help of Peculiar Velocities

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Over the last two decades, the rapid increase in both quantity and quality of cosmological observations has revealed growing evidence of discrepancies between values of key cosmological parameters within the standard model when measured using late vs early universe probes. Gravitational wave observations could provide new insight into these "cosmological tensions" by enabling independent measurements of contested parameters, such as the present-day expansion rate of the universe (H0). However, to do this, we require accurate measurements of gravitational wave signals, our observations of which are distorted by the local matter distribution during their propagation to Earth.

My research focuses on creating a map of galaxy motions in the local universe to determine matter density distribution and recover undistorted gravitational wave signals, enabling unbiased measurements of parameters like H0. Today, I will present a novel machine learning technique being developed to reconstruct the peculiar velocity field using redshift observations from the Dark Energy Spectroscopic Instrument (DESI). The key aspect of this new reconstruction technique is that is preserves information about galaxy motions on significantly smaller scales than previous methods, enabling more accurate recovery of undistorted gravitational wave signals.

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