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Boosting Time Resolution of a Velocity Interferometer Through a Moire Effect

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I describe a new technique for increasing the time resolution of velocity interferometry (VISAR) or other interferometry, where a fringe history is recorded by a multichannel detector. The technique is advantageous for the measurement of abrupt phenomena having short but nonzero risetime. The illumination intensity is modulated sinusoidally at a frequency similar to the maximum rate of fringe passage across the detectors at the abrupt phenomena. This creates beats or moire fringes, which are the high frequency components of the signal shifted to lower frequencies where they can better survive the limited frequency response of the detector. A method of reconstructing the original high frequency signal from the detected signal is demonstrated using simulated data. This method was inspired by, and is nearly analogous to the Moire effect that boosts spectral resolution in LLNL's recently developed externally dispersed interferometer (EDI) for the Doppler planet search. This work was performed under the auspices of the U.S. Department of Energy by the University of California, Lawrence Livermore National Laboratory under contract No. W-7405-Eng-48.