

Accurate Group Delay Measurement for Radial Velocity Instruments Using the Dispersed Fixed Delay Interferometer Method

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The dispersed fixed-delay Interferometer (DFDI) method is attractive for its low cost, compact size, and multiobject capability in precision radial-velocity (RV) measurements. The phase shift of fringes of stellar absorption lines is measured and then converted to an RV shift via an important parameter, phase-to-velocity scale (PV scale), determined by the group delay (GD) of a fixed-delay interferometer. Two methods of GD measurement using a DFDI Doppler instrument are presented in this article: (1) GD measurement using white-light combs generated by the fixed-delay interferometer and (2) GD calibration using an RV reference star. These two methods provide adequate precision of GD measurement and calibration, given the current RV precision achieved by a DFDI Doppler instrument. They can potentially be used to measure GD of an fixed-delay interferometer for submeter-precision Doppler measurement with a DFDI instrument. Advantages and limitations of each method are discussed in detail. The two methods can serve as standard procedures of PV-scale calibration for DFDI instruments and cross-checks for each other.

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