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(G*) Achromatic multi-mode time bin interferometer for quantum networks

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We present a novel quantum multi-mode time bin interferometer that is suitable for a wide range of optical signals and capable of being used for free space quantum channels. Our design uses only reflective optics with curved mirrors providing the one-to-one imaging system necessary for a multi-mode interferometer. The curved mirrors are ideal since, unlike lenses, their focal length depends only on the geometry of the mirror allowing them to be used with a wide range of optical signals and avoid chromatic effects. Furthermore, each curved mirror is placed in a cavity like configuration with a flat mirror, thus created a relatively smaller physical footprint. The small physical footprint allows the interferometer to be placed in a monolithic chassis that is built using additive manufacturing. Additive manufacturing enables nonconventional techniques that allowed for flexure optomechanical components to be built into the monolithic chassis enabling alignment of the interferometer with the reduced physical footprint. The monolithic chassis allows for increased robustness and gives a predictable thermal expansion. In addition, the use of low thermal expansion material, such as Invar, further increases the thermal tolerance of the interferometer, increasing the practicality of the device. Overall, this study advances the practicality of the multi-mode time bin interferometers for free space quantum applications. Thus, further enabling the deployment of quantum technologies to bring about new applications and fundamental research.

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