Abstract Submitted
for the DAMOP15 Meeting of
The American Physical Society

Spectral Filtering Using Low-Loss Diffraction Gratings CHRIS ZEITLER, Department of Physics, University of Illinois at Urbana-Champaign, DAVID SCHMID, Department of Physics, University of Toronto, PAUL KWIAT, Department of Physics, University of Illinois at Urbana-Champaign — Certain tasks in optics, such as loophole-free tests of Bell inequalities, require the use of narrow bandpass spectral filters with strict resolution and efficiency requirements due to the broad bandwidth of the entangled photons. Spectral filters based on diffraction gratings suffer from high levels of loss due to light leakage into undesired spatial modes. However, recent developments in resonant all-dielectric diffraction gratings have allowed diffraction efficiencies into the desired mode to exceed 99 percent. Additionally, the geometric nature of these filters allows tuning of the bandwidth, resolution, and efficiency over a wide range to suit a variety of applications. We demonstrate the use of the gratings as a broadband filter of a downconversion source, heralding the conjugate spectrum in the photon which never hits the diffraction grating. We also use optical masks in conjunction with the gratings to create unusually-shaped spectra, such as exponentials and step functions. Finally, we show that the gratings can be used to make narrowband filters with bandwidths as low as 30 picometers.

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Date submitted: 30 Jan 2015 Electronic form version 1.4