

Abstract Submitted  
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**Towards entanglement of very high orbital angular momentum<sup>1</sup>**

ROBERT FICKLER, RADEK LAPKIEWICZ, CHRISTOPH SCHAEFF, PEIZHE LI, SVEN RAMELOW, MARCIN WIESNIAK, ANTON ZEILINGER, University of Vienna, Faculty of Physics, IQOQI Vienna, Austrian Academy of Sciences, Austria — Orbital angular momentum (OAM) of single photons has become an often used tool to realize entanglement in higher dimensions [1,2]. Laguerre-Gaussian modes of light with their helical phase structure carry photonic OAM and thus can be used to define an infinitely dimensional discrete Hilbert. However, the creation of photonic OAM entanglement using the well known spontaneous parametric downconversion process is limited by the strongly reduced efficiency for higher momenta [3]. We investigate novel methods to create this entanglement between two photons with a very high difference in their OAM quantum number and momentum respectively. Furthermore we explore hybrid entanglement of photons in these spatial modes and polarization degree of freedom.

[1] G. Molina-Terriza, J. P. Torres, L Torner, Nature Physics 3, 305 (2007)

[2] A. Mair, A. Vaziri, G. Weihs, A. Zeilinger, Nature 412, 313 (2001)

[3] B. Jack, J. Leach, H. Ritsch, S. M. Barnett, M. J. Padgett, S. Franke-Arnold, NJP 11, 103024 (2009)

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Robert Fickler  
University of Vienna, Faculty of Physics, IQOQI Vienna,  
Austrian Academy of Sciences, Austria

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