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Conservation of Vacuum in an Interferometer DOMINIC BERRY, University of Waterloo, ALEXANDER LVOVSKY, University of Calgary — Source efficiency and photon loss are major problems in optical metrology and quantum information. To understand how to address loss for these applications, it is vital to know how the loss behaves under linear optical (LO) processing including conditional measurements. We have developed a theory for the behavior of loss under LO processing, resolving many long-standing questions from previous work [1,2]. In particular, we have shown that, provided the efficiency of the sources is appropriately quantified, the efficiency of the state in any single mode cannot be increased beyond that of the highest-efficiency mode available at the input [1]. It is also not possible to increase efficiency in a catalytic way, using some high-efficiency modes to increase the efficiency of other modes [2]. The results provide a powerful unifying framework for quantifying efficiency by the incoherent vacuum contribution to optical states, even when entangled over multiple modes. The amount of vacuum is invariant under interferometers, and can only be increased by measurement.

[1] D. W. Berry and A. I. Lvovsky, Phys. Rev.Lett.**105**, 203601 (2010).
[2] D. W. Berry and A. I. Lvovsky, e-print:1010.6302 (2010).

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