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Strong converse for the classical capacity of all phase-insensitive bosonic Gaussian channels BHASKAR ROY BARDHAN, Department of Physics and Astronmoy, Louisiana State University, USA, RAUL GARCIA-PATRON, Ecole Polytechnique de Bruxelles, Universite Libre de Bruxelles, Belgium and Max-Planck Institut fuer Quantenoptik, Germany, MARK M. WILDE, Department of Physics and Astronmoy and Center for Computation and Technology, Louisiana State University, USA, ANDREAS WINTER, ICREA & Fisica Teorica, Informacio i Fenomens Quantics, Universitat Autonoma de Barcelona, Spain — One of the most fundamental tasks in quantum information theory is to determine the classical capacity for a noisy communication channel. We prove that a strong converse theorem holds for the classical capacity of all phase-insensitive bosonic Gaussian channels, when imposing a maximum photon number constraint on the inputs of the channel. The pure-loss, thermal, additive noise, and amplifier channels are all in this class of channels. The statement of the strong converse theorem is that the probability of correctly decoding a classical message rapidly converges to zero in the limit of many channel uses if the communication rate exceeds the classical capacity. We prove this theorem by relating the success probability of any code with its rate of data transmission, the effective dimension of the channel output space, and the purity of the channel as quantified by the minimum output entropy. Our result bolsters the understanding of the classical capacity of these channels by establishing it as a sharp dividing line between possible and impossible communication rates over them.

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