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The scaling of LIGO's coating thermal noise with beam shape[1]
GEOFFREY LOVELACE, Theoretical Astrophysics, California Institute of Technology — An option for Advanced LIGO is to alter the light beam's cross sectional shape so as to reduce thermal noise in the mirrors' substrates and coatings. The influence of beam shape on substrate noise is fairly well understood[2], and J. Agresti has compared Gaussian and flat-top shapes for coating noise[3]. Unpublished analyses by R. O'Shaughnessy and S. Vyatchanin suggest that, if one approximates the mirrors as semi-infinite, the coating thermal noise below any point on the mirror surface is proportional to the square of the beam intensity *at that point*, i.e., the noise obeys a *local* scaling law. Using the fluctuation-dissipation theorem and elastostatics, I show that the correct scaling also includes *nonlocal* terms. I comment on the implications of this result for Advanced LIGO.

[1]NSF grant PHY-0099568
[2]E. D'Ambrosio, R. O'Shaughnessy, S. Strigin, K. Thorne and S. Vyatchanin, Phys. Rev. D submitted, gr-qc/0409075.

[3]Juri Agresti, preliminary results. LIGO-G050041-00-Z, available at http://www.ligo.caltech.edu/.

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