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Surface electromagnetic waves thermally excited: Radiative heat transfer, coherence properties and Casimir forces revisited in the near field

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Abstract

We review in this article the influence of surface waves on the thermally excited electromagnetic field. We study in particular the field emitted at subwavelength distances of material surfaces. After reviewing the main properties of surface waves, we introduce the fluctuation–dissipation theorem that allows to model the fluctuating electromagnetic fields. We then analyse the contribution of these waves in a variety of phenomena. They give a leading contribution to the density of electromagnetic states, they produce both temporal coherence and spatial coherence in the near field of planar thermal sources. They can be used to modify radiative properties of surfaces and to design partially spatially coherent sources. Finally, we discuss the role of surface waves in the radiative heat transfer and the theory of dispersion forces at the subwavelength scale.

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