Advanced homogenization techniques in a tokamak plasma medium with ellipsoidal blobs: Mathematical treatment

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Homogenization of a dielectric mixture is not a new concept, as it dates back to 1996 [1] for plasma mediums. All previous models that have been made have significant limitations. The most basic existing model ignores the shape of the blobs [1], while the more advanced ones fall short of correct predictions if the wavelength of the incoming beam is not much greater than the radius of the insert dielectric. We present a new formalism, tailored for magnetized plasmas which makes use of quantities that are known under Fourier transformations, such as Green's function and electric fields. This leads to a valid equation for any wavelength and blob (insert) size, which will need no modification if the filling ratio exceeds 50% (current formalisms need to invert the definitions of ambient plasma medium and blob in order to be valid). Finally, the equation can in turn be integrated in the Fourier space and then solved numerically to give the components of the dielectric tensor of the composite plasma medium. Results are only dependent upon (but not limited by) blob size, and there are no restrictions on wavelength magnitude.

References

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