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Experimental and computational study of 1/f noise scaling in single-walled carbon nanotube percolation films ASHKAN BEHNAM, GIJS BOSMAN, ANT URAL, University of Florida — We study the scaling of 1/f noise in single-walled carbon nanotube percolation films as a function of device parameters and film resistivity both experimentally and computationally. The results suggest that the noise generated by tube-tube junctions dominates the total 1/f noise in nanotube films and that the noise amplitude depends strongly on device dimensions, nanotube degree of alignment, and the film resistivity, following a power-law relationship with resistivity near the percolation threshold after properly removing the effect of device dimensions. We also find that the critical exponents associated with the noise-resistivity and noise-device dimension relationships are not universal invariants, but rather depend on the specific parameter that causes the change in the resistivity and 1/f noise, and the values of the other device parameters. Since 1/f noise is a more sensitive measure of percolation than resistivity, these results not only provide important fundamental physical insights into the complex interdependencies associated with percolation transport in nanotube films, but also help understand and improve the performance of these nanomaterials in potential device applications, such as nanoscale sensors, where noise is an important figure of merit.

Ashkan Behnam
University of Florida

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