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metal junctions with multiple transverse modes

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We compute analytically the full distribution of Andreev conductance \$G_ {\mathrm{NS}}\$ of a metal-superconductor interface with a large number \$N_c\$ of transverse modes, using a random matrix approach. The probability distribution $\operatorname{P}(G_{\mathrm{NS}}, N_c)\$ in the limit of large $N_c\$ displays a Gaussian behavior near the average value \$<G_{\mathrm{NS}}>= (2-\sqrt{2}) N_c\$ and asymmetric power-law tails in the two limits of very small and very large \$G_{\mathrm{NS}}\$. In addition, we find a novel third regime sandwiched between the central Gaussian peak and the power law tail for large \$G_{\mathrm{NS}}\$. Weakly non-analytic points separate these four regimes---these are shown to be consequences of three phase transitions in an associated Coulomb gas problem.

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