**Shukla Summary**

In Mello’s formalism, an evolution equation for Pz(M) was written down, and certain statistics calculated. But without knowledge of P(M) itself, our knowledge of P(g) was incomplete. Instead of trying to solve such an equation, Shukla conjectured that due to the CLT, the solution is likely Gaussian in nature, and sought to examine the implications of this conjecture (he does parenthetically explore the possibility that the solution may be of a more general form).



where μ is short for the set of indices {mns} specifying the row, column, and real/imaginary part of he matrix element. Aμ and Bμμʹ are unspecified Lagrange multipliers whose values would specify the average and correlation of the various matrix elements (the subscript s ranges over the real/imaginary part of the matrix element). C is the normalization constant. β = 1,2 is the usual symmetry parameter for TRS and its absence. Of course not all matrix elements are independent, as the presence of symmetry will enforce correlations between them. He argues that this conjecture is able to describe a conductor from the ballistic regime, where M is approximately diagonal Aμ ~ (ℓ/2z)δμμʹ, B ~ (ℓ/z)δμμʹ, to tbe insulating regime, where Aμ ~ 0, and Bμμʹ ~ z/ξ. The next order of business is to establish a FP equation for the evolution of this probability distribution. Of course the length, z, does not explicitly appear within the ansatz. Eliding some of the more rigorous details of his argument, one can say that whatever A’s and B’s dependence on z is, the derivative of P w/r to z must take the form of a total derivative: d/dz = (dAμ/dz)(∂P/∂Aμ) + (∂Bμμʹ/∂z)(∂P/Bμμʹ). This motivates putting together a combination of M-derivatives that evaluates to a general form: fμ(A,B)(∂P/∂Aμ) + fμμʹ(A,B)(∂P/Bμμʹ). This results in the following expression:



where,



and,



where γ is an arbitrary constant, and δμμʹ enforces equality of row/column part of the matrix element. Now we will identify the operator T as a total derivative w/r to some length-related parameter termed the ‘complexity’, Y. So explicitly:



and therefore we have:



Now that the FP equation for P(M) has been developed, we may work out the evolution equation for the transmission eigenvalues λ. We’ll first note that the FP equation implies the following microscopic averages for the matrix **M**ʹ.



Note that these averages are quite different than Mello’s and Tartar’s microscopic model. Here the average fluctuation of **M** is non-zero (though it could be made zero if we set γ = 0), and moreover the fluctuational variance is constant, rather than proportional to **M**2. Forming the matrix Q = MM† and considering its change, dQ = M·dM†+dM·M†+dM·dM†, one can write an equation for the evolution of its eigenvalues xn (see formula something) using the moments above and 2nd order perturbation theory. Fortuitously, all terms in the perturbative expansion, i.e., <dQ>**Mʹ**, <dQdQ>**M’** and <dQdQ\*>**Mʹ** reduce back to terms linear in the unperturbed Q itself. And so the xn evolution equation is closed. Changing variables to λn, we can use Appendix Whatever to write down the FP equation for Pz(**λ**). The result is as follows (changing the format of his result to make later comparisons more perspicuous):



where,



He notes that we recover the DMPK equation in the small λ limit given that Kii → 4, and, when multiplied through by λ(1+λ), the γ multiplicand → 0 (though note γ itself could simply be set to 0 anyway, given its arbitrariness). In this limit the standard DMPK results can be reproduced. In seems doubtfull that the large λ limit would likewise reproduce standard results. And this could be ascribed to the microscopic model produced by this ansatz, which makes the fluctuational variance of **M** constant, rather than proportional to **M2**.