Resonances in Quantum Graphs

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We consider a quantum graph with finite number of internal edges and some infinite leads equipped with Hamiltonian acting as negative second derivative. If the graph contains a loop of edges with lengths equal to integer multiples of l_0 and suitable coupling conditions are applied then eigenvalues $(n\pi/l_0)^2$ occur embedded in the continuous spectrum. We use Kuchment's flower-like model for describing these eigenvalues arised from correlations of lengths of the edges for a general graph. When changing the ratio of the lengths, the poles of the resolvent (formerly eigenvalues) may become resonances. In the general case we determine the total number of poles of the perturbed resolvent (with their multiplicities taken into account) in the neighbourhood of former eigenvalue. Furthermore, we derive a criterion for the asymptotics of resonances to be of a non-Weyl character. We construct examples of graphs with nontrivial coupling which do not preserve Weyl's law.