Channel Correlations in Wave Transport through Chaotic Systems

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We investigate experimentally by means of microwave cavities the channel correlations in a four port system. More precisely we study the correlation $C(\kappa) = \overline{\langle\sigma_{ab}(\kappa)\sigma_{cd}(\kappa)\rangle} - \overline{\langle\sigma_{ab}(\kappa)\rangle\langle\sigma_{cd}(\kappa)\rangle}$, where $\sigma_{ab}(\nu) = |S_{ab}(\nu)|^2$ with $a \neq b$, κ is the channel coupling strength, $\langle\cdots\rangle$ represents an average over frequency and system configurations and the $\overline{\cdots}$ over different combinations of the indices. We distinguish between two different possibilities, the so-called C_Σ-correlation (exactly one identical index) and C_Λ-correlation (no equal index). We observe that C_Σ and C_Λ are anti-correlated and thus give opposite contributions to the universal conductance fluctuations. All measured correlations are in good agreement with random matrix calculations once including coupling and absorption appropriately.