Attempts on Haemers' conjecture

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Haemers conjectures that almost all graphs are determined by their spectra, in other words almost all graphs have no cospectral mate or "one can hear the shape of almost all graphs". Suppose $G \sim \mathcal{G}(n,p)$ is a random graph with each edge chosen independently with probability p with $0 < p < 1$. Then

$$\Pr(G \text{ is not controllable}) + \sum_{\ell=2}^{n^{n^2}} \Pr(G \text{ has a generalized copsectral mate with level } \ell) \to 0$$

as $n \to \infty$ implies that almost all graphs are determined by their generalized spectra. It is known that almost all graphs are controllable. We show that almost all graphs have no cospectral mate with fixed level ℓ, namely

$$\Pr(G \text{ has a copsectral mate with level } \ell) \to 0$$

as $n \to \infty$ for every $\ell \geq 2$. The result can also be interpreted in the framework of random symmetric integral matrices.

This talk is based on joint work with Wei Wang.