1172-15-202 **Elizabeth Larson**, **Christoph Kirst** and **Marija Vucelja*** (mvucelja@virginia.edu),
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The spectra of "small-world" networks and its corollaries on the dynamics on such networks.

The term "small-world" describes a class of networks with highly clustered nodes and a short characteristic path length. Examples include the neural network of C. elegans, the power grid of the western United States, and a collaboration graph of actors. Since their identification, small-world networks in biological and societal contexts have been studied with various qualitative and quantitative measures. Motivated to find precise characterizations of such networks and to understand dynamics on such networks better, we derive the spectral density of an ensemble of small-world-like networks. Our ensemble is composed out of matrices that can be represented as a sum of a deterministic circulant matrix and a prescribed random matrix. We show that this ensemble of matrices has qualitatively the same spectra as the small-world networks. We obtain an implicit analytical expression for the spectra by utilizing the Pastur-Rogers formula. We analyze its main features and discuss continuous-time nonlinear dynamics on such networks. Finally, we study several real-world examples and point out qualitative similarities with the introduced random matrix ensemble. We suggest using the eigenvalues as a hallmark for a small-world property of a network. (Received August 28, 2021)