Central limit theorem for partial linear eigenvalue statistics of Wigner matrices

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In this paper, we study the complex Wigner matrices $M_n=\frac{1}{\sqrt{n}}W_n$ whose eigenvalues are typically in the interval $[-2,2]$. Let $\lambda_1\leq \lambda_2...\leq\lambda_n$ be the ordered eigenvalues of M_n. Under the assumption of four matching moments with the Gaussian Unitary Ensemble(GUE), for test function f 4-times continuously differentiable on an open interval including $[-2,2]$, we establish central limit theorems for two types of partial linear statistics of the eigenvalues. The first type is defined with a threshold u in the bulk of the Wigner semicircle law as $\mathcal{A}_n[f; u]=\sum_{l=1}^nf(\lambda_l)\mathbf{1}_{\{\lambda_l\leq u\}}$. And the second one is $\mathcal{B}_n[f; k]=\sum_{l=1}^{k}f(\lambda_l)$ with positive integer $k=k_n$ such that $k/n\rightarrow y\in (0,1)$ as n tends to infinity. Moreover, we derive a weak convergence result for a partial sum process constructed from $\mathcal{B}_n[f; \lfloor nt\rfloor]$.

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