The two flavour Schwinger model: the scalar condensate and the eigenvalue saturation of the pion propagator

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We investigate the continuum limit scaling of the scalar condensate in the $N_f = 2$ flavour Schwinger model on the lattice. We employ maximally twisted mass Wilson fermions and overlap fermions. We compute the scalar condensate by taking the trace of the propagator (direct method) and by utilizing the integrated Ward-Takahashi identity. While the scalar condensate comes out consistent using these two methods for a given kind of lattice fermions, we find—quite surprisingly—large discrepancies for the scalar condensate between twisted mass and overlap fermions. These discrepancies are only resolved when using the point split current for twisted mass fermions. We also perform a scaling test of the number of eigenmodes needed to represent the pion propagator to a certain precision.