

$N = 159 = 3 \cdot 53$

By the Ibukiyama-Kitayama dimension formula,
 $\dim(S_4(K(159))) = 59$

By the Skoruppa-Zagier dimension formula and Jacobi restriction,
the lift dimension of $S_4(K(159))^+$ is 26
the nonlift dimension of $S_4(K(159))^+$ is heuristically 29
 $\dim(S_4(K(159))^+)$ thus is heuristically 55
 $\dim(S_4(K(159))^-)$ is heuristically 4

The heuristic dimensions are correct by the spanning results to follow

$\dim(J_{\{2,159\}}^{\{\text{cusp}\}}) = 1$ (Skoruppa-Zagier), so need to span completely

$q = 5$ for TraceDown

After TD($\text{Grit}(J_{\{4,795\}}^{\{\text{cusp}\}})$) and $(\text{Grit}(J_{\{2,159\}}^{\{\text{cusp}\}}))^2$,
spanned rank in $S_4(K(159))^+$ is 55
spanned rank in $S_4(K(159))^-$ is 0

Hecke operators applied: $\{\{3, 2\}\}$

After Hecke spreading,
spanned rank in $S_4(K(159))^-$ is 1

After Borcherds products,
spanned rank in $S_4(K(159))^-$ is 4

Final spanned rank in $S_4(K(159))^+$ is 55

Final spanned rank in $S_4(K(159))^-$ is 4

 $S_2(K(159))^+$ is determined by Jacobi restriction and the $H4Nd1(1,+)$ test
($\dim(H_4(159,1,1)^+) \leq 1$ and this is less than $\dim(J_{\{2,159\}}^{\{\text{cusp}\}})+1 = 2$)
 $S_2(K(159))^- = 0$ by Jacobi restriction and the $H4Nd1(1,-)$ test
($\dim(H_4(159,1,1)^-) \leq 0$ and this is less than $\dim(J_{\{2,159\}}^{\{\text{cusp}\}}) = 1$)

So $S_2(K(159)) = \text{Grit}(J_{\{2,159\}}^{\{\text{cusp}\}})$ (dimension 1)