Then the spectral resolution of $L^2(F)$ *reads*

(7)

$$g(n) = \sum_{i=1,2} < g, u_i > u_i(n) + 2\pi \int_0^\pi < g, \tilde{f}_\theta > \tilde{f}_\theta(n) \frac{d\theta}{(q-1)^2 + 4q\sin^2\theta} .$$

We end this paper by showing that, as one might expect from the theory of Eisenstein series, the eigenfunctions f_λ can be parametrized as a family of functions that depend holomorphically on a complex parameter. Precisely, let

$$E(n, s) = q^{ns}(q^{s-1} - q^{1-s}) + q^{n(1-s)}(q^s - q^{-s}) .$$

Then $E(n, s)$ is entire in s and satisfies the functional equation

$$E(n, s) = -E(n, 1-s) .$$

Furthermore, a direct computation shows that

$$(TE)(n, s) = (q^s + q^{1-s})E(n, s) .$$

There are two ways in which $\lambda = q^s + q^{1-s}$ can be real. Write $s = \sigma + it$. If $t = \frac{k\pi}{\log q}$ then $\lambda = (-1)^k(q^\sigma + q^{1-\sigma})$, and in particular

$$\lambda = q + 1 (\lambda = -(q+1))$$

if $\sigma = 1$ and k is even (k is odd). Otherwise we must have $\sigma = \frac{1}{2}$. If we write $t = \frac{\theta}{\log q}$ we obtain our $\lambda = 2\sqrt{q}\cos\theta$.

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