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Archimedean Stark conjectures and real analytic Eisenstein series

In this talk we will present a construction of real analytic Eisenstein series $E(z, s)$ attached to a totally real field K , $E(z, s)$ being real analytic in z and holomorphic in s . We will present a precise formula for its Fourier series expansion around z . Having such an explicit formula at our disposal, we will then prove a functional equation which relates $E(z, s)$ to its so-called "dual Eisenstein series" $E^*(z, 1 - s)$. It turns out that the constant term of this Fourier series is a partial zeta function $\zeta(s)$ in the complex variable s weighted by a sign character. In the special case when $\text{ord}_{s=0}(\zeta(s)) = 1$, it is expected that $\zeta'(0)$ is equal to the logarithm of a global unit in an abelian extension of K . In order to get some insights about a possible solution of this outstanding conjecture, we will present a (classical) proof of this conjecture in the special case when $K = \mathbf{Q}$ which involves Cauchy's classical residues theorem.