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Poincaré Series of Weil and Igusa Type for Elliptic Curves.

Let K be a unramified degree d extension over \mathbb{Q}_p , O_d its ring of integers, $f(\vec{x}) \in \mathbb{Z}[\vec{x}]$, and $N_{d,e} = x \in (O_d/p^e O_d)^n | f(x) \equiv 0 \pmod{p^e}$. Fixing e , a generalized Weil Zeta function is equal to $\exp(\sum_{d=1}^{\infty} \frac{|N_{d,e}|}{d} T^d)$. The Weil zeta function, the case $e = 1$, was shown to be rational by B. Dwork in 1959. Meuser later showed the rationality for any fixed positive e . The Igusa zeta function, shown to be rational by Igusa in 1975, is related to fixing d and summing over all non-negative e . Both of these zeta functions have associated Poincaré Series which are rational due to the rationality of their zeta functions. Our work has focused on combining the Weil and Igusa information to form a Weil-Igusa Poincaré Series, the double sum over d and e of $|N_{d,e}| p^{-den} T^d W^e$. In 1986, Meuser showed that these series have a meromorphic continuation to \mathbb{C} but are not in general rational. In the case of elliptic curves, we have found we can make all such series rational by multiplying by p^{-de} rather than p^{-2de} . This talk will explain the computation of the $|N_{d,e}|$'s for the Kodaira-Néron reduction types of an elliptic curve, how multiplying by p^{-de} can be justified, and the form of these Poincaré Series. (Received July 26, 2007)