公開セミナー

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講師：岡崎龍太郎（同志社大学）

On Weber's Class Number Problem and Cyclotomic Unit

Let $f = 2^{n+2} \geq 8$ and $\beta_j = \cos(2j\pi/f)$. Set $K = \mathbf{Q}(\beta_1)$, $(\deg K = f/4)$ and $h_n = h(K)$. Weber calculated $h_1 = h_2 = h_3$ and conjectured $h_n = 1$ always holds for $n \geq 1$. Later Bauer and Masley showed $h_4 = 1$ and Linden showed $h_5 = 1$. Recently K.Horie initiated a project of proving this conjecture of Weber's. Fukuda and Komatsu made a progress.

They use the identity of h_n and the index of the cyclotomic units of K in the full unit group of K. Horie isolated a relative units among them and related them with the ratio h_n/h_{n-1}.

Therefore, a lower bound on the size of a relative units is important.

Then, $\beta_1 \longmapsto \beta_k$ induces an automophism of K, which sends $\alpha \in K$ to $\alpha^{\sigma(j)} \in K$. The field K is equipped with the metric $\alpha \in K \longmapsto \|\alpha\| = \sqrt{(\alpha^{2\sigma(1)} + \alpha^{2\sigma(3)} + \cdots + \alpha^{2\sigma(f/2-1)})/\deg K}$.

Let ϵ be a unit of K so that its norm to the unique subfield of K of degree $\deg K/2$ equals -1. Then, we prove $\|\epsilon\| \geq f/2 - 1$.

世話人　秋山茂樹（7481）