
Academic Report (2020-21)



Harish - Chandra Research Institute
Chhatnag Road, Jhunsi
Prayagraj - 211019, India

Kalyan Chakraborty

Research Summary:

During the last academic year 2020-2021 my research was focussed on the arithmetic problems related to Selmer groups and Tate - Shafarevich groups associated to algebraic cycles on a variety defined over a number field. We have been able to prove some finiteness result for some quotient of the group of algebraic cycles by using these new constructions of Selmer and Tate Shafarevich groups and asymptotic formulae for sums of the form $\sum_{m \leq X} a_K^l(m)$. One important application is the weak Mordell-Weil theorem for the Chow group of zero cycles of any smooth projective variety defined over a number field. We are also trying to relate various questions related to the class number of algebraic number fields with that of Selmer groups and Tate-Shafarevich groups associated to elliptic curves and also with other higher genus curves.

I am also involved into other questions like sums of integral squares, Diophantine tuples and that of various interesting Diophantine equations in the ring of integers or that of S-integers in number fields.

Publications:

1. C. Ray and K. Chakraborty, *Certain eta-quotients and l-regular overpartitions*, The Ramanujan Journal, (2021).
2. K. Chakraborty and A. Hoque, *Exponents of class groups of certain imaginary quadratic fields*, Czechoslovak Mathematical Journal **70**, 1167-1178, (2020).
3. K. Chakraborty, A. Hoque and R. Sharma *Complete solutions of certain Lebesgue-Ramanujan-Nagell equations*, Publicationes Mathematicae Debrecen **97**, 339-352, (2020).
4. K. Chakraborty , A. Hoque and R. Sharma, *On the solutions of certain Lebesgue-Ramanujan-Nagell equations*, Rocky Mountain Journal of Mathematics **51(2)**, 459-471, (2021).
5. K. Chakraborty, A. Hoque and M. Mishra, *On the structure of order 4 class groups of $\mathbb{Q}(\sqrt{n^2 + 1})$* , Annales mathématiques du Québec **45**, 203-212, (2021).
6. K. Chakraborty, A. Hoque and S. Kotyada, *On the Diophantine equation $cx^2 + p^{2m} = 4y^n$* , Results in Mathematics **57**, (2021).
7. R. Agnihotri, K. Chakraborty and M. Mishra, *Primary rank of class groups of real cyclotomic fields*, Rocky Mountain Journal of Mathematics **50(6)**, 2149-2155, (2020).
8. R. Agnihotri and K. Chakraborty, *Sign changes of certain arithmetical functions at prime powers*, Czechoslovak Mathematical Journal, (2021).
9. R. Agnihotri and K. Chakraborty, *On the Fourier coefficients of certain Hilbert modular forms*, The Ramanujan Journal, (2021).

10. S. Banerjee, K. Chakraborty and A. Hoque, *An analogue of Wilton's formula and values of Dedekind zeta functions*, Journal of Mathematical Analysis and Applications **495(1)**, pp 124675, (2021).
11. K. Chakraborty, K. Banerjee and A. Hoque, *Divisibility of class groups and selmer groups*, Hardy-Ramanujan Journal **42**, (2020).
<https://doi.org/10.46298/hrj.2020.6460>
12. Kalyan Chakraborty and Chiranjit Ray, *Distribution of generalized mex related integer partitions*, Hardy-Ramanujan Journal **43**, May 6, 2021..
<https://doi.org/10.46298/hrj.2021.7425>

Preprints:

1. K. Chakraborty AND K. Krishnarjun, *On moments of non-normal number fields*. (communicated)
2. K. Chakraborty, S. Kenmitsu and A. Laurinćikas, *Complex powers of L-functions and integers without large prime factors*. (communicated)
3. K. Chakraborty and A. Hoque, *On the plus parts of the class numbers of cyclotomic fields*. (communicated)
4. K. Banerjee and K. Chakraborty, *Tate-Shafarevich group and Selmer group constructions for Chow group of an abelian variety*. (communicated)
5. K. Banerjee and K. Chakraborty, *On the Chow group of the self-product of a cm elliptic curve defined over a number field*. (communicated)
6. R. Sharma, S. Batter and K. Chakraborty, *On a family of elliptic curves of rank at least 2*. (communicated)
7. Kalyan Chakraborty and Azizul Hoque, *On the Diophantine equation $dx^2 + p^{2a}q^{2b} = 4y^p$* . (communicated)

Invited Lectures/Seminars:

1. *Unique factorization, its failure and its measure*, International Conference on Number Theory and Algebra, IIT(BHU), December, 2020.
2. *Prime numbers and some related conjectures*, Conference of the Indian Mathematical Society, VIT, Vellore, December, 2020.
3. *Divisibility of class numbers*, BHU, September, 2020.

Other Activities:

1. Chief Organiser of International conference commemorating Srinivasa Ramanujan December, 2020 (<https://sites.google.com/ksom.res.in/conference2020/>).
2. Reviewed five papers for of AMS and refereed four manuscripts for various leading journals.