RESEARCH STATEMENT

MOHAMMAD REZA RAHMATI

My major interests lie in Hodge theory, and its related areas. Hodge theory and its arithmetic applications are quite interesting for me both over the field of complex numbers $\mathbb{C}$ and in the l-adic (p-adic) case. Many parts of Hodge theory such as intractions with K-theory, representation theory, modular forms, Calabi-Yau varieties and mirror symmetry are of my interest.

Ph.D studies

One of the important subject of study in Hodge theory and D-modules is the behaviour of the underlying variation of (mixed) Hodge structures in the extensions. We will consider the VMHS associated to isolated hypersurface singularities in the affine space $\mathbb{C}^{n+1}$. The mixed Hodge structure would be the Steenbrink limit mixed Hodge structure. Classically there are two equivalent ways to define this MHS. One method which is actually due to J. Steenbrink himself is by applying a spectral sequence argument to the resolution of the singularity in projective fibration followed with Invariant cycle theorem. Another method which is equivalent to the first is to define it by the structure of lattices in the Gauss-Manin system associated to VMHS on the punctured disc.

Theorem 0.1. [R1] *Assume $f : (\mathbb{C}^{n+1}, 0) \to (\mathbb{C}, 0)$, is a holomorphic germ with isolated singularity at 0, with $f : X \to T$ the associated Milnor fibration. Embed the Milnor fibration in a projective fibration $f_Y : Y \to T$ of degree d (with d large enough), by inserting possibly a singular fiber over 0. Then, the isomorphism Φ makes the following diagram commutative up to a complex constant;*

$$\begin{array}{ccc} \widehat{Res}_{f,0} : \Omega_f \times \Omega_f & \longrightarrow & \mathbb{C} \\ \big\downarrow (\Phi^{-1}, \Phi^{-1}) & & \big\downarrow \times * \\ S : H^n(X_\infty) \times H^n(X_\infty) & \longrightarrow & \mathbb{C} \end{array} \qquad * \neq 0 \tag{1}$$

where,

$$\widehat{Res}_{f,0} = res_{f,0}\ (\bullet, \tilde{C}\ \bullet)$$

Key words and phrases. Mixed Hodge structure, Opposite filtration, p-adic period map, Motivic fundamental group, Algebraic cycles, Modularity of Calabi-Yau manifolds, Bloch-Beilinson filtration, l-adic local systems.

and $\tilde{C}$ is defined relative to the Deligne decomposition of Ω_f, via the isomorphism Φ. If $J^{p,q} = \Phi^{-1} I^{p,q}$ is the corresponding subspace of Ω_f, then

$$\Omega_f = \bigoplus_{p,q} J^{p,q} \qquad \tilde{C}|_{J^{p,q}} = (-1)^{p(d-1)/d} \tag{2}$$

In other words;

$$S(\Phi^{-1}(\omega), \Phi^{-1}(\eta)) = * \times \ res_{f,0}(\omega, \tilde{C}.\eta), \qquad 0 \neq * \in \mathbb{C} \tag{3}$$

Corollary 0.2. *(Riemann-Hodge bilinear relations for Ω_f) Assume the holomorphic isolated singularity Milnor fibration $f : X \to T$ can be embedded in a projective fibration of degree d with $d >> 0$. Suppose $\mathfrak{f}$ is the corresponding map to N on $H^n(X_\infty)$, via the isomorphism Φ. Define*

$$P_l = PGr_l^W := \ker(\mathfrak{f}^{l+1} : Gr_l^W \Omega_f \to Gr_{-l-2}^W \Omega_f)$$

Going to W-graded pieces;

$$\widehat{Res}_l : Gr_l^W \Omega_f \otimes_{\mathbb{C}} Gr_l^W \Omega_f \to \mathbb{C} \tag{4}$$

is non-degenerate and according to Lefschetz decomposition

$$\Omega_f = \bigoplus_r \mathfrak{f}^r P_{l-2r}$$

we will obtain a set of non-degenerate bilinear forms,

$$\widehat{Res}_l \circ (id \otimes \mathfrak{f}^l) : PGr_l^W \Omega_f \otimes_{\mathbb{C}} PGr_l^W \Omega_f \to \mathbb{C}, \tag{5}$$

$$\widehat{Res}_l = res_{f,0} \ (id \otimes \tilde{C}.\ \mathfrak{f}^l) \tag{6}$$

where $\tilde{C}$ is as in 8.6.1, such that the corresponding hermitian form associated to these bilinear forms is positive definite. In other words,

- $\widehat{Res}_l(x, y) = 0, \qquad x \in P_r, \ y \in P_s, \ r \neq s$
- *If $x \neq 0$ in P_l,*

$$res_{f,0} \ (C_l x, \tilde{C}.\ \mathfrak{f}^l.\bar{x}) > 0$$

where C_l is the corresponding Weil operator, cf. 2.2.8, and the conjugation is as in 8.10.

Here X_∞ is the canonical Milnor fiber, and Ω_f is the module of relative differentials associated to f. The above theorem gives a formulation of Riemann-Hodge bilinear relations for Grothendieck residue.

In [R2] I have provided several proofs for the above conjecture using different techniques. In [R5] we have tried to extend the above result for any admissible variation of mixed Hodge structure using D-modules.

Theorem 0.3. [R5] *Assume $\mathcal{M} = (M, F, W, K)$ be a polarized MHM with underlying admissible variation of mixed Hodge structure K, defined on a Zariski dense open subset U of an algebraic manifold X. Assume $X \setminus U = D$ is a normal crossing divisor defined by a holomorphic germ f. Then the extended MHM is polarized and in a neighborhood of D, the polarization of the extension of $\mathcal{M}$ is given either by a sign modification of the Grothendieck residue associated to the holomorphic germ f defining the normal crossing divisor or partial residues of a moderate extension of the former polarization. Moreover, the Hodge filtration on the extended fibers are opposite to the limit Hodge filtration on K. These Hodge filtrations pair together to constitute a polarized complex variation of HS.*

The induced bilinear forms on the corresponding family of Jacobians will also behave similarly.

Theorem 0.4. [R5] *The extension of the Poincare product on the canonical fibers of the Neron model for a degenerate projective family having an admissible variation of Hodge structure is given either by the sign modification of the residue pairing or the partial residues as in Theorem 0.2. This process describes the extended Jacobian as the Jacobian of the Opposite Hodge filtration on the module of relative differentials or the Jacobi ring, and in this way provides a non-natural isomorphism between the canonical and extended Jacobians.*

The asymptotic behavior of Hodge structure in a degenerate family of varieties has its origin in the work of W. Schmid proving the two famous nilpotent orbit and $\mathfrak{sl}_2$-orbit theorems. It provides a significant approach in the study of period map which is one of the attractive and non-separable part of research in Hodge theory. I believe the Lie algebra analysis provides a suitable background for research in this area and opens inter-actions with other areas such as Shimura varieties.

In [R4] I have tried to extend the Higher residue pairing of Kyoji Saito to crystalline site. There exists a $K = \text{Frac}(W(k))$-sesquilinear form

$$WK^f(\ ,\ ) : W\widehat{\mathcal{H}}^f_{(0)} \times W\widehat{\mathcal{H}}^f_{(0)} \to W\widehat{\mathcal{O}}_{S,0}[[t]]$$

The period map construction between crystalline and etale cohomology with coefficient in $\mathbb{C}_p$ provides an isomorphism;

$$R\Gamma^{alg}_{dR}(X) \otimes_{\overline{K}} \mathbb{C}_p \to R\Gamma_{et}(X, \mathbb{Q}_p) \otimes_{\mathbb{Q}_p} \mathbb{C}_p$$

where K is the field of fractions of $W(k)$, and $\bar{K}$ is a fixed algebraic closure. The form of K. Saito is one of the beatiful constructions both in algebraic and differential geometry, [S1].

1. Research plan

As a purspective I prefer to do research in Hodge theory by the following motivations

1.1. **Hodge theory and representation theory of Lie algebras.** Many standard methods of Lie algebras and their representations can be applied to the theory of polarized variation of mixed Hodge structures, their asymptotic behavior and naturally to other parts of Hodge theory. Lie algebra analysis provides a deeper understanding of the limit Hodge structures and the boundary points of period domains in the compactifications.

Let $\mathcal{L}(W)$ be the set of all gradings of W the weight filtration for a Hodge structure (H, F, W). There is a natural injection

$$\mathcal{L}(W) \to W_0^{\mathfrak{gl}}$$

which assigns to any grading $H = \oplus H_l$ the semisimple endomorphism $T \in \mathfrak{gl}(H)$ with integral eigenvalues whose l-eigenspace is H_l. $W_0^{\mathfrak{gl}}$ is a Lie subalgebra of $\mathfrak{gl}(H)$ containing $W_{-1}^{\mathfrak{gl}}$ as a nilpotent ideal. The $\mathbb{C}$-algebraic group $expW_{-1}^{\mathfrak{gl}}$ acts simply transitively on $\mathcal{L}(W)$, by

$$(exp(X), T) \to e^{ad\ X}(T) = T + [X, T] + ... \in T + W_{-1}^{\mathfrak{gl}}$$

This implies there exists a unique $Z \in \mathfrak{g}^{-1,-1}$ such that

$$\overline{J^{p,q}} = e^{Z} J^{p,q}, \qquad \bar{Z} = -Z$$

Thus we may write $Z = -2i\delta$. One defines another Hodge filtration

$$\tilde{F} := e^{i.\delta}.F$$

Since $\delta \in \mathfrak{g}_{\mathbb{R}}^{-1,-1} \subset W_{-2}^{\mathfrak{gl}}$, this element leaves W invariant and acts trivially on the quotient Gr_l^W. Therefore both $F, \tilde{F}$ induce the same filtrations on $Gr_l^W H$. Now it is clear that

$$e^{-i.\delta}.J^{p,q} = e^{i.\delta}.\overline{J^{p,q}}$$

gives a real splitting for H.

Theorem 1.1. *(*[CKS] *sec. 2) Given a mixed Hodge structure (W, F), there exists a unique $\delta \in \mathfrak{g}_{\mathbb{R}}^{-1,-1}(W, F)$ s.t. $(W, e^{-i\delta}.F)$ is a mixed Hodge structure which splits over $\mathbb{R}$. Every morphism (W, F) commutes with δ, thus, the morphisms of (W, F) are precisely those morphisms of $(W, e^{i.\delta}.F)$ which commute with this element.*

Perhaps one of the two most important observations in asymptotic Hodge theory is the nilpotent orbit and sl_2 orbit theorems,

Theorem 1.2. *(Nilpotent Orbit Theorem - W. Schmid) (*[SCH] *Theorem 4.9 and 4.12)*

Let $\Phi : (\triangle^*)^r \times \triangle^{n-r} \to D$ be a period map, and let $N_1, ..., N_r$ be monodromy logarithms. Let

$$\psi : (\triangle^*)^r \times \triangle^{n-r} \to \check{D} \tag{7}$$

be the un-twisted period map; then

- *The map ψ extends holomorphically to $(\triangle)^r \times \triangle^{n-r}$.*
- *For each $w \in \triangle^{n-r}$, the map $\theta : \mathbb{C}^r \times \triangle^{n-r} \to \check{D}$ given by*
$$\theta(z, w) = \exp(\sum z_j N_j).\psi(0, w)$$
is a nilpotent orbit. Moreover, for, $w \in C$ a compact subset, there always exists $\alpha > 0$ such that $\theta(z, w) \in D$ for $Im(z_j) > \alpha$.
- *For any G-invariant distance on D, there exists positive constants β, K such that for $Im(z_j) > \alpha$,*

$$d(\Phi(z, w), \theta(z, w)) \leq K \sum_j (Im(z_j))^\beta e^{-2\pi Im(z_j)}. \tag{8}$$

Moreover, the constants α, β, K depend only on the choice of the metric d and the weight and Hodge numbers used to define D. They may be chosen uniformly for w in a compact subset.

Nilpotent orbit theorem is the basic tool to study the limit mixed Hodge structure. Limit Hodge filtrations can be considered as a naive boundary point of period domains. Its proof concerns the study of some estimates on the invariant metric on $\check{D}$ obtained by polarization.

Theorem 1.3. *($\mathfrak{sl}_2$-orbit Theorem - W. Schmid) (*[SCH] *Theorem 5.3) Let $z \to \exp(z.N).F$ be a nilpotent orbit. Then there exists,*

- *A filtration $F_{\sqrt{-1}} := \exp(iN).F_0$ lies in D.*
- *A homomorphism $\rho : \mathfrak{sl}(2, \mathbb{C}) \to \mathfrak{g}$, Hodge at $F_{\sqrt{-1}}$.*
- *$N = \rho(X_-)$*
- *A real analytic $G_\mathbb{R}$-valued function $g(y)$, such that;*
- *For $y >> 0$, $\exp(iy.N).F = g(y) \exp(iyN).F_0$, where $F_0 = \exp(-iN).F_{\sqrt{-1}}$.*
- *Both $g(y)$ and $g(y)^{-1}$ have convergent power series expansion at $y = \infty$ of the form $1 + \sum A_n y^{-n}$ with*

$$A_n \in W_{n-1}\mathfrak{g} \cap \ker(adN)^{n+1} \tag{9}$$

This theorem first discovered by W. Schmid and later was developed by E. Cattani and A. Kaplan and also G. Pearlstein in different directions. $\mathfrak{sl}_2$-orbit theorem should be understood as a matter of interaction of representation theory with Hodge structures. In other words it distinguishes from a nilpotent orbit another sub-orbit which is split over $\mathbb{R}$. They both provide a rich back ground in the study of asymptotic behaviour of Hodge structures.

Let X be an irreducible Hermitian symmetric domain, and G the corresponding simple $\mathbb{R}$-algebraic group, $T \subset G_{\mathbb{C}}$ a maximal algebraic torus. The restriction to T of the adjoint representation

$$T \to G_{\mathbb{C}} \to Gl(\mathfrak{gl}_{\mathbb{C}})$$

breaks into 1-dimensional eigenspaces on which T acts through characters:

$$\mathfrak{g}_{\mathbb{C}} = \mathfrak{t} \oplus (\bigoplus_{\alpha \in R} \mathfrak{g}_{\alpha})$$

Properties of adjoint representation for the automorphism group of the polarization form and root system structure of its lie algebra allows to describe these structures and classify their Mumford-Tate groups and Mumford-Tate domains systematically.

A significant presentation of this can be that of CM Hodge structures, related to CM abelian varieties and class field theory.

Theorem 1.4. [K] *(a) For a simple complex abelian g-fold A, the following are equivalent:*

- *The Mumford-Tate group of $H^1(A)$ is a torus.*
- *$End(A)_{\mathbb{Q}}$ has maximal rank $2g$ over $\mathbb{Q}$.*
- *$End(A)_{\mathbb{Q}}$ is a CM field.*
- *$A \cong \mathbb{C}^g/\Phi(a)$ for some CM type (E, Φ) and an idea $\mathfrak{a} \subset \mathcal{O}_E$.*

(b) Furthuremore, any complex torus of the form above is algebraic.

1.2. **Modularity of Calabi-Yau varieties.** The Shimura-Taniyama-Weil conjecture on modularity of L-function of Elliptic curves proved by A. Wiles, has been generalized over Calabi-Yau varieties in higher dimensions.

Theorem 1.5. *(Shimura-Tanyama-Weil Conjecture - A. Wiles)* [W] *Suppose E is a semi-stable Elliptic curve defined over $\mathbb{Q}$. Then E is modular.*

A Calabi-Yau manifold is a compact complex manifold with trivial canonical bundle. A one dimensional Calabi-Yau manifold is an Elliptic curve. A simply connected Calabi-Yau manifold is a K3 surface.

Conjecture 1.6. *(Modularity Conjecture)* [Y] *Any rigid Calabi-Yau 3-fold X over $\mathbb{Q}$ is modular in the sense that, up to finite Euler factors,*

$$L(H^3_{et}(\bar{X}, \mathbb{Q}), s) = L(f, s), \qquad f \in S_4(\Gamma_0(N))$$

The question arises to which higher dimensional Calabi-Yau varieties are modular. For K3 surfaces the question has been answered positively by Shioda and Inose. This conjecture has been answered in some special cases in low dimension 3. Special properties of Calabi-Yau manifolds and their variations has made this line of research involving many beautiful number theoretic motivations. The question mainly says that the L-function of a Calabi-Yau variety defined over $\mathbb{Q}$ is the L-function of a modular form.

Studying Calabi-Yau variations in its own way provides a good example of HS. Their variation satisfies special symmetries, that makes them interesting for mathematicians in different areas such as Mirror symmetry, Hodge theory and Number theory, [N].

1.3. **Algebraic cycles and higher Chow groups and motives.** Hodge theory initiates with theory of algebraic cycles, Chow groups, Intermediate Jacobians, Abel-Jacobi maps and regulators which connect them together. The cycle class and Abel-Jacobi maps are,

$$cl_k : CH^k(X) \to H^{2k}(X, \mathbb{Z}(k))$$

$$\Phi_k : CH^k_{hom}(X) \to J^k(X) := \frac{H^{2k-1}(X, \mathbb{C})}{F^0 H^{2k-1}(X, \mathbb{C}) + H^{2k-1}(X, \mathbb{Z})}$$

Conjecture 1.7. [L] *For smooth and proper X defined over $\bar{\mathbb{Q}}$, the complex Abel-Jacobi map*

$$\Phi_k : CH^k_{hom}(X/\bar{\mathbb{Q}})_{\mathbb{Q}} \to J^k(X(\mathbb{C}))_{\mathbb{Q}}$$

is injective.

Since Φ_k is in general not injective, one anticipate that the kernel of Φ_k can be explained by kernels of successive higher regulator maps, defining a filtration

$$CH^k(X/\mathbb{C})_{\mathbb{Q}} = F^0 \supset F^1 \supset ... \supset F^k \supset 0$$

where $F^1 = \ker cl_{k,\mathbb{Q}}$, $F^2 = \ker \Phi_{k,\mathbb{Q}}$. This is fortified by Beilinson conjectural formula

$$Gr^l_F CH^k(X)_{\mathbb{Q}} = Ext_{\mathcal{MM}}(1, h^{2k-l}(X)(k))$$

where $\mathcal{MM}$ is the conjectural category of mixed motives, [L].

Conjecture 1.8. [L] *For smooth complex projective variety X, that can be defined over a number field, the regulator map*

$$r : CH^j(X, 1)_{\mathbb{Q}} \to \Gamma(H^{2j-1}(X, \mathbb{Q}(j)))$$

is surjective, where $\Gamma(-) = hom(1, -)$.

All of these concepts can also be studied in a family of varieties and the concept of a normal function corresponds to sections for the bundle of Jacobians associated to a VHS.

$$\nu : \mathcal{S} \to \mathcal{O}_{\mathcal{S}}\big(\coprod_{t\in\mathcal{S}} J(H^{2r-m-1}(\mathcal{X}_t, \mathbb{Q}(r)))\big)$$

$$\nabla_J : \Gamma(\mathcal{J}) \to \Gamma(\Omega_{\mathcal{S}} \otimes R^{2r-m-1}\rho_* \Omega^{\bullet < r-1}_{\mathcal{X}/\mathcal{S}})$$

and ν is called horizontal if $\nabla_J(\nu) = 0$, [L].

In case of degenerate families their limit or extension behavior, their singularties and infinitesimal properties becomes interesting. Different techniques in asymptotic of HS can be applied to obtain information on the limit.

1.4. **Motivic fundamental group.** The concept of motives concerns the comparison theorems between de Rham, Betti or l-adic cohomologies. The comparison theorem concerns an isomorphism between de Rham and Betti cohomologies which is given by integration along homology cycles, for dR-B and concerns an isomorphism between crystalline and etale cohomology after a base change by Fontaine ring, for dR-et. . The reduction of the latter says crystalline and etale cohomologies are equivalent in some sense.

The role of the projective line minus three points $X = \mathbb{P} \setminus \{0, 1, \infty\}$ in relation to Galois theory can be traced back to the theorem,

Theorem 1.9. *(Belyi-1979) Every smooth projective algebraic curve defined over $\bar{\mathbb{Q}}$ can be realized as a ramified cover of $\mathbb{P}^1$.*

Belyi deduced that the absolute Galois group of $\mathbb{Q}$ acts faithfully on the profinite completion of the fundamental group of X, i.e. the map

$$Gal(\bar{\mathbb{Q}}/\mathbb{Q}) \to Aut(\hat{\pi}_1(X(\mathbb{C}, b))$$

Theorem 1.10. [B] *There is an ind-object*

$$\mathcal{O}(\pi_1^{mot}(X, \overrightarrow{1_0}, -\overrightarrow{1_1})) \in Ind(\mathcal{MT}(\mathbb{Z}))$$

whose Betti and de Rham realizations are the affine rings $\mathcal{O}\pi_1^B(X, \overrightarrow{1_0}, -\overrightarrow{1_1}))$ and $\mathcal{O}(\pi_1^{dR}(X))$, respectively.

there is an exact sequence

$$0 \to I \to \mathbb{Q}[\pi_1^{top}(X(\mathbb{C}), x))] \to \mathbb{Q} \to 0$$

where I is the augmentation ideal. Then one has

$$\mathcal{O}(\pi_1^B(X, x)) = \lim_{N\to\infty} (\mathbb{Q}[\pi_1^{top}(X, x)]/I^{N+1})^\vee$$

when $X = \mathbb{P}^1 \setminus \{0, 1, \infty\}$ we have

$$\mathcal{O}_1^{dR}(X)) \cong \bigoplus_{n \geq 0} H^1_{dR}(X)^{\otimes n}$$

This notion is closely related to the former construction and K-theory of number fields with their decomposition into eigen-spaces of Adams operations. It involves many open questions from Grothendieck till now, as C. Soule, S. Bloch, etc... , [KP].

1.5. **Galois representations and l-adic local systems.** The classical finiteness theorem for abelian varieties generalizing that of G. Faltings has been discussed in the l-adic case by P. Deligne.

Theorem 1.11. [CS] *Let S be a finite set of places of K. There are only finitely many isogeny classes of abelian varieties over K, of a given dimension which have good reductions outside S.*

This theorem mainly states that in an abelian scheme fiberation there exists finitely many isomorphism classes of polarized abelian varieties. In other words, there could be finitely many isomorphism classes of monodromy representations for $(S, s)/\mathbb{C}$ of rank $\leq r$ and weight n. The theorem has already discussed by P. Griffiths concerning $\mathbb{Z}$-polarized variation of Hodge structure over S. In addition to beauty of this theorem and its proof, its generalization for the schemes over finite fields opens more interesting ideas of ramification theory using Swan index of l-adic representations of etale fundamental group and the Deligne-Weil group.

Theorem 1.12. [D], [HM] *There are only finitely many irreducible lisse $\bar{\mathbb{Q}}_l$-sheaves of given rank up to twist on a normal connected scheme X of finite type over a finite field of char > 0.*

Let $\mathcal{R}_r(X)$ be the set of lisse $\bar{\mathbb{Q}}_l$-Weil sheaves on X of dimension r and up to semi-simplification. For X connected such a sheaf is nothing but an r-dimensional l-adic representation of $W(X)$. A weaker version of the theorem then says the number of classes of irreducible sheaves in $\mathcal{R}_r(X)$ with bounded wild ramification is finite up to twist.

Theorem 1.13. *(P. Deligne) Assume X is smooth separated $/\mathbb{F}_q$ be connected, and $\bar{X}$ be a normal compactification of X with $D = \bar{X} \setminus X$ a normal crossing divisor. Let $\mathcal{R}_r(X, D)$ be the set of representations whose Swan conductor along any smooth curve mapping to $\bar{X}$ is bounded by D. Then the set of irreducible sheaves $V \in \mathcal{R}_r(X, D)$ is finite up to twist by elements of $\mathcal{R}_1(\mathbb{F}_q)$.*

The proof concerns a parametrization of the Frobenius attached to each point of the variety. Studying the irregularity of l-adic representations using the Swan index is another deep construction in the l-adic Hodge theory which also uses local class field theory tools. I believe that this theorem with its different generalizations is one of the elegant constructions in mathematics both in statement and proof. I think it has the value of working out more and the capacity to generate more knowledge, [HM].

References

[B] Brown F. , Motivic Periods and $\mathbb{P}^1 \setminus \{0, 1, \infty\}$, arxiv.math 2014

[CKS] E. Cattani, A. Kaplan, W. Schmid, Degeneration of Hodge structure, Ann. of math, , second series, Vol 123, 1986

[CS] Cornell G., Silverman J. , Arithmetic geometry, Springer-Verlag , Chap. 2, expos. by G. Faltings, 1985

[D] Deligne P. , Letter to Drinfeld dated June 18, 2011, 9 pages

[HM] Esnault H., Kerz M., A finiteness theorem for Galois representations of function fields over finite fields, arxiv:math 2012

[K] Kerr M. , Shimura varieties, A Hodge theory perspective, ICTP summer school on Hodge theory 2010

[KP] Kerr M., Pearlstein G., An exponential history of functions with logarithmic growth

[L] Lewis J. D. , A filtration on the Chow groups of a complex projective variety, compos. math. 128, 2001

[N] Noriko Y. , Arithmetic of Calabi-Yau varieties, 2004

[R1] Rahmati M., On the mixed Hodge structure associated to hypersurface singularities, arxiv:math

[R2] Rahmati M., Positivity of Hochster Theta, arxiv:math

[R3] Rahmati M. , Serre multiplicity question and Mukai pairing, arxiv:math

[R4] Rahmati M. , Higher residue pairing over P-ring, arxiv:math

[R5] Rahmati R. , Asymptotic of polarization in PVMHS, arxiv:math

[R6] Rahmati M., Hodge theory of isolated hypersurface singularity, A study of asymptotic polarization, Ph.D Thesis, CIMAT

[S1] K. Saito; The higher residue pairings, for a family of hypersurface singular points, Proceedings of Symposia in pure mathematics, Vol 40 (1983) Part 2.

[SCH] W. Schmid: Variation of Hodge structure: the singularities of the period mapping. Invent, math. 22 (1973) 211-320

[W] Wiles A. , Modular elliptic curves and Fermat last theorem, Annales of math. 141 (1995) 443-551

[Y] Yi Y. , On the modularity of rigid Calabi-Yau threefolds, J. Math. Kyoto Univ., (2004)

,

E-mail address: `mrahmati@cimat.mx`