

# **Periods and Nori Motives**

Annette Huber and Stefan Müller-Stach,  
with contributions of  
Benjamin Friedrich and Jonas von Wangenheim

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Bibliography

# Bibliography

- [Ae] A. Aeppli: Modifikation von reellen und komplexen Mannigfaltigkeiten, *Comm. Math. Helv.*, 31, 219–301 (1956).
- [A1] Y. André: Galois theory, motives and transcendental numbers, in: Renormalization and Galois theories, *IRMA Lect. Math. Theor. Phys.* 15, Eur. Math. Soc., Zürich, 165–177 (2009).
- [A2] Y. André: Une introduction aux motifs, *Panoramas et Synthèse* 17, Société Mathématique de France (2004).
- [AF] A. Andreotti, T. Fraenkel: The Lefschetz theorem on hyperplane sections, *Ann. of Math.* (2) 69, 713–717 (1959).
- [Ar] D. Arapura: An abelian category of motivic sheaves, *Advances in Mathematics* Volume 233, Issue 1, 135–195 (2013).
- [A] Artin, M.: Théorème de finitude pour un morphisme propre; dimension cohomologique des schémas algébriques affines. In SGA 4, tome 3, XIV, *Lect. Notes Math.*, Vol. 305, Berlin-Heidelberg-New York: Springer, 145–168 (1973).
- [AM] M. Artin, B. Mazur: Étale homotopy, *Lecture Notes in Mathematics*, No. 100, Springer-Verlag, Berlin-New York (1969).
- [AH] M. Atiyah, W. Hodge: Integrals of the second kind on an algebraic variety, *Ann. of Math.* 62, 56–91 (1955).
- [Ba] R. Baer: Zur Einführung des Scharbegriffs, *Crelle Journal Band* 160, Heft 4, 199–207 (1929).
- [Be1] A. Beilinson: On the derived category of perverse sheaves, in: *K-Theory, Arithmetic, and Geometry* (Moscow, 1984-1986), Springer LNM 1289, Berlin, 27–41 (1987).
- [Be2] A. Beilinson: Notes on absolute Hodge cohomology, in: *Applications of algebraic K-theory to algebraic geometry and number theory*, Part I, II (Boulder, Colo., 1983), *Contemp. Math.*, 55, Amer. Math. Soc., Providence, RI, 35–88 (1986).

- [BB] P. Belkale, P. Brosnan: Periods and Igusa local zeta functions, *Int. Math. Res. Not.*, no. 49, 2655–2670 (2003).
- [BEK] S. Bloch, H. Esnault, D. Kreimer: On motives associated to graph polynomials, *Comm. Math. Phys.* 267, no. 1, 181–225 (2006).
- [B1] F. Brown: Mixes Tate motives over  $\mathbb{Z}$ , *Ann. of Math.* (2) 175, no. 2, 949–976 (2012).
- [B2] F. Brown: Motivic periods and  $\mathbb{P}^1 \setminus \{0, 1, \infty\}$ , Proceedings of the ICM Seoul 2014, see arXiv:1407.5165 (2014).
- [B3] F. Brown: Multiple zeta values and periods of moduli spaces  $\bar{M}_{0,n}$ , *Ann. Sci. Éc. Norm. Supér.* (4) 42, no. 3, 371–489 (2009).
- [Br] A. Bruguières: On a tannakian theorem due to Nori, Preprint, see <http://www.math.univ-montp2.fr/~bruguieres/docs/ntan.pdf> (2004).
- [Br] G. Bredon: Topology and Geometry, Graduate Texts in Mathematics, 139. Springer-Verlag, New York (1993).
- [D1] P. Deligne: Valeurs de fonctions L et périodes d’intégrales, *Proc. Sympos. Pure Math.*, XXXIII, Automorphic forms, representations and L-functions (Proc. Sympos. Pure Math., Oregon State Univ., Corvallis, Ore., 1977), Part 2, Amer. Math. Soc., Providence, R.I., 313–346 (1979).
- [D2] P. Deligne: Hodge cycles on abelian varieties, in: P. Deligne, J. Milne, A. Ogus and K.Y. Shih: Hodge Cycles, Motives, and Shimura Varieties, Springer LNM 900, 9–100 (1982).
- [DG] P. Deligne, A. Goncharov: Groupes fondamentaux motiviques de Tate mixte, *Ann. Sci. École Norm. Sup.* (4) 38, no. 1, 1–56 (2005).
- [DM] P. Deligne, J. Milne: Tannakian categories, in: P. Deligne, J. Milne, A. Ogus and K.Y. Shih: Hodge Cycles, Motives, and Shimura Varieties, Springer LNM 900, 101–228 (1982).
- [D2] P. Deligne: Théorie des Hodge II, *Publication Mathématique IHES* 40, 5–57 (1971).
- [D3] P. Deligne: Théorie des Hodge III, *Publication Mathématique IHES* 44, 5–77 (1974).
- [DMOS] P. Deligne, J.S. Milne, A. Ogus, K. Shih: Hodge cycles, motives, and Shimura varieties, Springer LNM 900 (1982).
- [Dur] A. Durfee: A naive guide to mixed Hodge theory, Singularities, Part 1 (Arcata, Calif., 1981), *Proc. Sympos. Pure Math.*, 40, Amer. Math. Soc., Providence, RI, 313–320 (1983).

- [Eb] D. Eisenbud: Commutative Algebra with a View Toward Algebraic Geometry, Graduate Texts in Mathematics, 150, Springer Verlag, New York (1994).
- [Fi] G. Fichtenholz: Differential- und Integralrechnung II, Tenth edition, translated from the Russian by Brigitte Mai and Walter Mai, Hochschulbcher fr Mathematik Nr. 62, VEB Deutscher Verlag der Wissenschaften, Berlin (1990).
- [F] E. Friedlander: Étale homotopy of simplicial schemes, Annals of Math. Studies Nr. 104, Princeton Univ. Press (1982).
- [Fri] G. Friedman: Survey article: an elementary illustrated introduction to simplicial sets, Rocky Mountain J. Math. 42, no. 2, 353–423 (2012).
- [Fr] B. Friedrich: Periods and algebraic de Rham cohomology, Diplomarbeit Univ. Leipzig 2004, see arXiv:math.AG/0506113v1 (2005).
- [Fu] W. Fulton: Intersection theory, Ergebnisse der Mathematik, 3. Folge, Band 2, Springer Verlag, Berlin (1984).
- [Ge] T. Geisser: Arithmetic cohomology over finite fields and special values of  $\zeta$ -functions, Duke Math. J. 133, no. 1, 27–57 (2006).
- [GM] S. Gelfand, Y. Manin: Homological Algebra, Springer Verlag, Berlin (1999).
- [God] R. Godement: Topologie algébrique et théorie des faisceaux, Publ. Math. Univ. Strasbourg. No. 13, Hermann, Paris (1958).
- [GM] A. Goncharov, Y. Manin: Multiple  $\zeta$ -motives ad moduli spaces  $\bar{M}_{0,n}$ , Compos. Math. 140, no. 1, 1–14 (2004).
- [G1] A. B. Goncharov: The double logarithm and Manin’s complex for modular curves, Math. Res. Let. 4, 617–636 (1997).
- [G2] A. B. Goncharov: The dihedral lie algebra and Galois symmetries of  $\pi_1^l(\mathbb{P}^1 - (\{0, \infty\} \cup \mu_n))$ , Duke Math. J. 110, no. 3, 397–487 (2001).
- [G3] A. B. Goncharov: Multiple polylogarithms and mixed Tate motives, see arXiv:math.AG/0103059v4 (2001).
- [GR] H. Grauert, R. Remmert: Theorie der Steinschen Räume, Grundlehren der Mathematischen Wissenschaften, 227, Springer-Verlag, Berlin-New York (1977).
- [GH] P. Griffiths, J. Harris: Principles of Algebraic Geometry, Wiley Interscience, New York (1978).
- [Gro1] A. Grothendieck: On the de Rham cohomology of algebraic varieties, Publication Mathématique IHES 29, 95–103 (1966).

- [Gro2] A. Grothendieck: EGA V, unpublished manuscript, scan available at <http://www.jmilne.org/math/Documents/>.
- [Gun] R. Gunning: Introduction to Holomorphic Functions of Several Variables, vol. 1, Wadsworth, Pacific Grove, CA (1990).
- [H] R. M. Hain: Classical polylogarithms, Motives (Seattle, WA, 1991), Proc. Sympos. Pure Math., 55, Part 2, Amer. Math. Soc., Providence, RI, 3–42 (1994).
- [HZ] R. M. Hain, S. Zucker: A guide to unipotent variations of mixed Hodge structures, Hodge theory (Sant Cugat, 1985), Lecture Notes in Math., 1246, Springer, Berlin, 92–106 (1987).
- [Ha] D. Harrer: Thesis in preparation, Freiburg (2015).
- [Ha1] R. Hartshorne: On the de Rham cohomology of algebraic varieties, Publication Mathématique IHES 45, 1–99 (1971).
- [Ha2] R. Hartshorne: Algebraic Geometry, Graduate Texts in Mathematics, No. 52. Springer-Verlag, New York-Heidelberg (1977).
- [Hat] A. Hatcher: Algebraic topology, Cambridge Univ. Press, Cambridge (2002).
- [He] R. Henderson: The algebra of multiple zeta-values, Thesis university of Durham (2012).
- [Hi1] H. Hironaka: Resolution of singularities, Ann. of Math. 79, 109–326 (1964).
- [Hi2] H. Hironaka: Triangulation of algebraic sets, Triangulations of algebraic sets. Algebraic geometry (Proc. Sympos. Pure Math., Vol. 29, Humboldt State Univ., Arcata, Calif., 1974), Amer. Math. Soc., Providence, R.I., 165–185 (1975).
- [Hu1] A. Huber: Mixed Motives and their Realization in Derived Categories, Lecture Notes in Mathematics, 1604, Springer-Verlag, Berlin (1995).
- [Hu2] A. Huber: Realization of Voevodsky’s motives, J. Algebraic Geom. 9, no. 4, 755–799 (2000).
- [Hu3] A. Huber: Corrigendum to: Realization of Voevodsky’s motives [J. Algebraic Geom. 9, no. 4, 755–799 (2000)], J. Algebraic Geom. 13, no. 1, 195–207 (2004).
- [HMS] A. Huber, S. Müller-Stach: On the relation between Nori motives and Kontsevich periods, Preprint, see arXiv:1105.0865 (2011).
- [HJ] A. Huber, C. Jörder: Differential forms in the h-topology, Algebr. Geom. 1, no. 4, 449–478 (2014).

- [HW] A. Huber, J. Wildeshaus: The classical polylogarithm, abstract of a series of lectures given at the workshop on polylogs in Essen, 1997, see arXiv:1210.2358 (2012).
- [Hui] J. Huisman: Real algebraic differential forms on complex algebraic varieties, *Indag. Math. (N.S.)* 11, no. 1, 63–71 (2000).
- [Ja] U. Jannsen: Mixed motives and algebraic K-theory, with appendices by S. Bloch and C. Schoen, Springer LNM 1400, Berlin (1990).
- [Jo] J.-P. Jouanolou: Théorèmes de Bertini et applications, *Progress in Math.* vol 42, Birkhäuser, Boston (1983).
- [Joe] C. Jörder: On the Poincaré Lemma for reflexive differential forms, Dissertation, Albert-Ludwigs-Universität Freiburg, arXiv:1401.7495 (2014).
- [dJ] A.J. de Jong: Smoothness, semi-stability and alterations, *Inst. Hautes Études Sci. Publ. Math.* No. 83, 51–93 (1996).
- [Joh] P. T. Johnstone: Affine categories and naturally Malcev categories, *Journal of Pure and Applied Algebra* 61, 251–256 (1989).
- [KS] M. Kashiwara, P. Schapira,: Sheaves on manifolds, with a chapter in French by Christian Houzel, *Grundlehren der Mathematischen Wissenschaften*, 292, Springer-Verlag, Berlin (1990).
- [Kj] T. Kleinjung: Gerahmte gemischte Tate-Motive und die Werte von Zetafunktionen zu Zahlkörpern an den Stellen 2 und 3, Dissertation, Rheinische Friedrich-Wilhelms-Universität Bonn, Bonner Mathematische Schriften, Nr. 340 (2000).
- [Kn] C.M. Knighten: Differentials on quotients of algebraic varieties, *Trans. Am. Math. Soc.* 177, 65–89 (1973).
- [K] M. Kontsevich: Operads and motives in deformation quantisation, *Letters in Mathematical Physics* 48, 35–72 (1999).
- [KZ] M. Kontsevich, D. Zagier: Periods, In: B. Engquist and W. Schmid, editors, *Mathematics unlimited – 2001 and beyond*, Springer Verlag, Berlin, 771–808 (2001).
- [KB] B. Koopman, A. Brown: On the covering of analytic loci by complexes, *Trans. Amer. Math. Soc.* 34, 231–251 (1932).
- [Le] M. Levine: Mixed motives, *K-theory Handbook*, Vol. 1, 429–521, Berlin, 2005
- [LW] F. Lecomte, N. Wach: Le complexe motivique de Rham, *Manuscripta Math.* 129, no. 1, 75–90 (2009).

- [ML] S. MacLane: Categories for the working mathematician, Graduate Texts in Mathematics, Vol. 5, Springer-Verlag, New York-Berlin (1971).
- [Ma] H. Matsumura: Commutative Algebra, W.A. Benjamin, New York (1970).
- [May] J.P. May: Simplicial objects in algebraic topology, Van Nostrand Mathematical Studies, No. 11 D. Van Nostrand Co., Inc., Princeton, N.J.-Toronto, Ont.-London (1967).
- [Me] W. Messing: Differentials of the first, second, and third kinds, Proc. Arcata conference, AMS Proc. of Symposia Vol. 29, 547–562 (1974).
- [Mi] J. Milne: Etale cohomology, Princeton Mathematical Series, 33, Princeton University Press, Princeton, N.J. (1980).
- [MM] J. Milnor, J. Moore: On the structure of Hopf algebras, Ann. of Math. 81(2), 211–264 (1965).
- [MWZ] S. Müller-Stach, S. Weinzierl, R. Zayadeh: Picard-Fuchs equations for Feynman integrals, Communications in Math. Physics 326, 237–249 (2014).
- [N] M. Nori: Lectures at TIFR, LaTeX notes by N. Fakhruddin, unpublished, 32 pages (2000).
- [N1] M. Nori: Handwritten notes titled "Motives", distributed around 1997 in the Esnault-Viehweg seminar at Essen, unpublished, 27 pages.
- [N2] M. Nori: Constructible sheaves, Proc. Int. Conf. on Algebra, Arithmetic and Geometry (2000), Part I, II, Mumbai, Tata Inst. Fund. Res. Stud. Math. Vol. 16, 471–491 (2002).
- [Pa] I. Panin: Push-forwards in oriented cohomology theories of algebraic varieties: II, after I. Panin and A. Smirnov, Preprint Nr. 619, K-theory preprint archive, see <http://www.math.uiuc.edu/K-theory/0619/> (2003).
- [Pr] H. Prüfer: Theorie der Abelschen Gruppen, Math. Zeitschrift Band 20, 165–187 (1924).
- [Re] L. E. Renner: Linear Algebraic Monoids, Encyclopaedia of mathematical sciences, Vol. 134, Springer Verlag (2005).
- [Sa] N. Saavedra Rivano: Catégories Tannakiennes, Lecture Notes in Mathematics, Vol. 265. Springer-Verlag, Berlin-New York (1972).
- [Sb] A. Seidenberg: A new decision method for elementary algebra, Annals of Math. 60, no. 2, 365–374 (1954).

- [Sch1] J. Scholbach: Geometric motives and the h-topology, *Mathematische Zeitschrift* 272, 956–986 (2012).
- [Sch2] J. Scholbach:  $f$ -cohomology and motives over number rings, *Kodai Math. J.* 35, no. 1, 1–32 (2012).
- [Schll] A.J. Scholl: Remarks on special values of L-functions, In: L-functions and arithmetic (Durham, 1989), London Math. Soc. Lecture Note Ser. 153, Cambridge Univ. Press, 373–392 (1991).
- [Schü] J. Schürmann, Topology of Singular Spaces and Constructible Sheaves, Instytut Matematyczny Polskiej Akademii Nauk, Monografie Matematyczne (New Series) 63, Birkhäuser Verlag, Basel (2003).
- [Se1] J. P. Serre: Géométrie algébrique et géométrie analytic, *Ann. Inst. Fourier* 6, 1–42 (1956).
- [Se2] J. P. Serre: A Course in Arithmetic, Graduate Texts in Mathematics, No. 7. Springer-Verlag, New York-Heidelberg (1973).
- [Sil] J. Silverman: The Arithmetic of Elliptic Curves, Graduate Texts in Mathematics, 106, Springer-Verlag, New York (1992).
- [Sp] E. H. Spanier: Algebraic Topology, Springer Verlag (1966).
- [St] J. Steenbrink: A summary of mixed Hodge theory, *Motives* (Seattle, WA, 1991), Proc. Sympos. Pure Math., 55, Part 1, Amer. Math. Soc., Providence, RI, 31–41 (1994).
- [Str] R. Street: Quantum groups, Australian Mathematical Society Lecture Series, Cambridge Univ. Press, Cambridge (2007).
- [Vi] K. Vilonen: Master Thesis, Harvard University, unpublished.
- [Voe] V. Voevodsky: Homology of schemes, *Selecta Math. (N.S.)* 2, no. 1, 111–153 (1996).
- [VSF] V. Voevodsky, A. Suslin, E. Friedlander: Cycles, transfers, and motivic homology theories, Annals of Mathematics Studies 143, Princeton University Press, Princeton (2000).
- [vW] J. von Wangenheim: Nori-Motive und Tannaka-Theorie, Diplomarbeit, Universität Freiburg, see arXiv:1111.5146 (2011).
- [W] F. Warner: Foundations of Differentiable Manifolds and Lie Groups, Graduate Texts in Mathematics 94, Springer-Verlag, New York-Berlin (1983).
- [Wed] T. Wedhorn: On Tannakian duality over valuation rings, *J. Algebra* 282, 575–609 (2004).

- [We] C. Weibel: An introduction to homological algebra, Cambridge Studies in Advanced Mathematics 38, Cambridge Univ. Press, Cambridge (1994).
- [Z1] J.Zhao: Multiple polylogarithms: analytic continuation, monodromy, and variations of mixed Hodge structures, Contemporary trends in algebraic geometry and algebraic topology (Tianjin, 2000), Nankai Tracts Math., 5, World Sci. Publ., River Edge, NJ, 167–193 (2002).
- [Z2a] J. Zhao: Analytic continuation of multiple polylogarithms, *Anal. Math.* 33, no. 4, 301–323 (2007).
- [Z2b] J. Zhao: Variations of Mixed Hodgestructures of Multiple Polylogarithms, *Canad. J. Math.* 56, no. 6, 1308–1338 (2004).
- [Z2] J. Zhao: Analytic continuation of multiple zeta functions, *Proc. of the AMS*, Vol. 128, Nr. 5, 1275–1283 (1999).
- [SGA1] A. Grothendieck: Séminaire de Géométrie Algébrique du Bois Marie - 1960-61 - Revêtements tâles et groupe fondamental - (SGA 1), Lecture notes in mathematics 224, Springer-Verlag, Berlin-New York (1971).
- [SGA3] M. Demazure, A. Grothendieck: Séminaire de Géométrie Algébrique du Bois Marie 1962/64 (SGA 3), Schémas en groupes, Vol 1, Lecture Notes in Mathematics 151, Springer Verlag, Berlin-New York (1970).
- [SGA4.2] Théorie des topos et cohomologie étale des schémas, Tome 2, Séminaire de Géométrie Algébrique du Bois-Marie 1963–1964 (SGA 4), dirigé par M. Artin, A. Grothendieck et J. L. Verdier, avec la collaboration de N. Bourbaki, P. Deligne et B. Saint-Donat, Springer LNM 270 (1970).
- [SGA4V] J.-L. Verdier: Cohomologie dans les topos, Exposé V, 1–82, in: Théorie des topos et cohomologie étale des schémas, Tome 2, Séminaire de Géométrie Algébrique du Bois-Marie 1963–1964 (SGA 4), dirigé par M. Artin, A. Grothendieck et J. L. Verdier.
- [SGA4Vbis] B. Saint-Donat: Techniques de descent cohomologique, Exposé Vbis, 83–162, in: Théorie des topos et cohomologie étale des schémas, Tome 2, Séminaire de Géométrie Algébrique du Bois-Marie 1963–1964 (SGA 4), dirigé par M. Artin, A. Grothendieck et J. L. Verdier.
- [SGA 4 1/2] P. Deligne: Cohomologie étale, Séminaire de Géométrie Algébrique du Bois-Marie SGA 4 1/2, avec la collaboration de J. F. Boutot, A. Grothendieck, L. Illusie et J. L. Verdier, Lecture Notes in Mathematics, Vol. 569, Springer-Verlag, Berlin-New York (1977).