CURRICULUM VITAE

Nicolas Ressayre	born 27 decembre 1973
Institut Camille Jordan (UMR 5208)	Married, 3 sons
University Claude Bernard Lyon 1	Professor
69622 Villeurbanne	ressayre@math.univ-lyon1.fr

TITLES AND DIPLOMAS

2007	Habilitation to Supervise Research
2000	PhD from Université Grenoble 1.
1996	Aggregation of Mathematics (4th).
	DEA (mention TB).
1993	Entry at the Ecole Normale Supérieure de Lyon.

PROFESSIONAL EXPERIENCE

Dec 2011. . .	Full professor at Université Lyon 1.
2001-2011	Maître de conférences at Université Montpellier II.
2000-01	Postdoctoral fellow at the University of Geneva.
1997-1998	Military service.
1997 and 99	ṔhD student at Université Grenoble 1.
1993-1996	Schooling at ENS Lyon.

RESEARCH ANIMATION

Funding	ANR GeoLie project leader from 2015 to 2020
	IUF contract from 2012 to 2018
Locally	Member of committees for recruitment or promotions, organizer of seminars or working groups. . .
	Head of the Algebra-Geometry-Logic team of the ICJ since May 2018. Team with 53 members. Writing of the HCERES report, Organization of the team day, Profiles for job applications, Member of the management committee and the scientific committee of the laboratory
Conferences	Organization of the rotating colloquium on the theory of representations in 2004
	Organization of the Sophus Lie Seminar in 2013
	Organization of a thematic half-term of the Labex MiLyon in 2014
	Organization of the international conference « Algebraic groups: Geometry, Actions and Structures » in 2018 in Lyon
	Organization of the AGL team day in Lyon in 2019
	Organization of the summer school « Immeubles et Grassmanniennes affines » for 2 weeks in Luminy in 2019.
Expertise	Member of the editorial board of Asterisk
	Referee for many journals
	Reporter for ANR, ERC and NSA projects
	Reporter on teacher-researcher applications for foreign universities
	Member of the Scientific Committee of Cofund MathInParis2020

Supervision	Co-supervision with L. Manivel of Michael Lebarbier's thesis defended in 2009. Supervision of Maxime Pelletier's thesis defended in 2017. Co-supervision with K. Iohara of Khanh NGuyen's thesis from 2017 to 2021. Supervision of Luca Francone's thesis 2021-2024. Uffe Jorgensen, thesis student under the supervision of Niels Lauritzen did a 6-month internship in Montpellier in 2012.
Jury	Reviewer for five PhD, participation in 11 thesis juries and 3 HDR juries
Collaborations	7 co-authors from my laboratory, 2 national collaboration (L. Manivel, PE Chaput) and 7 American co-authors (P. Belkale, S. Gao, S. Kumar, J. Landsberg, G. Orelowitz, E. Richmond, A. Yong).

PEDAGOGICAL RESPONSIBILITIES

2014 -2018	President of the training commission of the DEM of Lyon 1 (number 2 of the department). Management of services, recruitment of ACEs, numerous temporary staff, drafting of a model, management of current affairs, replacement of the director in the event of his absence. . .
2013 -	Elected member of the DEM council of Lyon 1.
2023 –	Responsible for the implementation of the assessment by skills for the DEM
2005-2010	Member of the office of the teaching department in Montpellier.
2005-2009	Member of various reflection committees on teaching in Montpellier.
2008-2010	Responsible for the MFA course of the license of Montpellier.
2003-2004	Responsible for the preparation for the aggregation in Montpellier.

CENTRAL FUNCTIONS

2019 – 2023	Elected member of the council of the Faculty of Sciences
2018 –	Member of the ethics committee of the University Lyon 1
2014 – 2018	As number 2 of the mathematics department regular participations in various central councils of the University Lyon 1
2013 – 2018	Elected member of the council of the Faculty of Sciences and Technology of the University of Lyon 1

HONORS

ICM 2014	Invited speaker in the session « Lie Theory and Generalizations » .
IUF 2012	Junior member of the Institut Universitaire de France.
Bourbaki	On November 11, 2011, Michel Brion presented work by Belkale, Kumar and myself at the Bourbaki seminar.
2012	Eligible on ERC starting Grants project

Articles

1. *Newell-Littlewood numbers III: The saturated cone,*
   Shiliang Gao, Gidon Orelowitz, , **Nicolas Ressayre** et Alexander Yong.
   To appear in Compositio Mathematica, 21pp.

2. *On the faces of the tensor cone of symmetrizable Kac-Moody Lie algebras,*
   Shrawan Kumar, **Nicolas Ressayre**
   To appear in Ann. Sci. ENS, 50 pp.

3. *On the multiplicity spaces of spherical subgroups of minimal rank,*
   Luca Francone, **Nicolas Ressayre**
   Bulletin of the London Math Scoiety, **55** (2023), no. 6, 2660–2684.

4. *On the automorphisms of the Drinfel'd double of a Borel Lie subalgebra,*
   Michaël Bulois, **Nicolas Ressayre**
   Journal of Algebra **47** (2024), 515–532.

5. *Reductions for branching coefficients,*
   Pierre-Emmanuel Chaput, **Nicolas Ressayre**
   IMRN, (2023), no. 17, 15207–15265.

6. *Some unexpected properties of Littlewood-Richardson coefficients,*
   Maxime Pelletier, **Nicolas Ressayre**
   Electron. J. Combin. 29 (2022), no. 4, Paper No. 4.11, 25 pp.

7. *On the tensor semigroup of affine Kac-Moody Lie algebras,*
   Nicolas Ressayre
   Journal of the AMS, **35** (2022), no. 2, 309-–360.

8. *Combinatorics of Newell-Littlewood numbers,*
   Shiliang Gao, Gidon Orelowitz, , **Nicolas Ressayre** and Alexander Yong.
   Sém. Lothar. Combin. , **86B** (2022), Art. 18, 12pp.

9. *Reductions for branching coefficients,*
   Nicolas Ressayre
   J. Lie Theory, **31** (2021), no. 3, 885-–896.

10. *Vanishing symmetric Kronecker coefficients,*
    Nicolas Ressayre
    Beiträge zur Algebra und Geometrie / Contributions to Algebra and Geometry, **61** (2020), no. 2, 231-–246.

11. *Horn inequalities for nonzero Kronecker coefficients,*
    Nicolas Ressayre
    Advances in Math., **356** (2019), 21pp.

12. *Permanent v. determinant: An exponential lower bound assuming symmetry and a potential path towards Valiant's conjecture,*
    Joseph Landsberg, **Nicolas Ressayre**
    Differential Geometry and its Applications, **55** (2017), 146 –166.

13. *Distribution on homogeneous spaces and Belkale-Kumar's product,*
    Nicolas Ressayre
    PROGR. MATH., 326, 481 – 526, Birkhäuser/Springer, Cham, 2018.

14. *Permanent v. determinant: an exponential lower bound assuming symmetry [extended abstract],*
    Joseph Landsberg, **Nicolas Ressayre**
    ITCS'16 – PROCEEDINGS OF THE 2016 ACM CONFERENCE ON INNOVATIONS IN THEORETICAL COMPUTER SCIENCE, 29–35, ACM, New York, 2016.

15. *Generalisations of the PRV conjecture II,*
    Pierre-Louis Montagard et Boris Pasquier, **Nicolas Ressayre**
    J. PURE APPL. ALGEBRA,**219** (2015), no. 12, p. 5560 – 5572

16. *The saturation property for branching rules – Examples,*
    Boris Pasquier, **Nicolas Ressayre**
    EXPERIMENTAL MATHEMATICS, **22** (3), p. 1–22, 2013.

17. *A generalization of the Fulton conjecture for arbitrary groups,*
    P. Belkale, S. Kumar et **N. Ressayre**
    MATHEMATSCHE ANNALEN, **354**, Pp. 401–425, 2012.

18. *Two generalizations of the PRV conjecture,*
    PL. Montagard, B. Pasquier, **N. Ressayre**
    COMPOSITIO MATHEMATICA, **147** (04), pages 1321–1336, 2011.

19. *Multiplicative formulas in Cohomology of G/P and in quiver representations,*
    Nicolas Ressayre
    INDAG. MATH., **22**(1-2), p. 87–102, 2011.

20. *Hypersurfaces with degenerate duals and the Geometric Complexity Theory Program,*
    J. Landsberg, L. Manivel, **Nicolas Ressayre**
    COMMENTARII MATH HELV. , **88** (2), pages 469–484, 2011.

21. *A cohomology free description of eigencones in type A, B and C,*
    Nicolas Ressayre
    INTERNATIONAL MATH RESEARCH NOTICES (IMRN), **2012**, Issue 21, Pp. 4966–5005, 2012.

22. *A short geometric proof of a conjecture of Fulton,*
    Nicolas Ressayre
    ENS. MATH (2), **57**, pages 103-115, 2011.

23. *GIT-cones and quivers,*
    Nicolas Ressayre
    MATHEMATISCHE ZEITSCHRIFT (online first), pages 1–13, 2011.

24. *Geometric Invariant Theory and Generalized Eigenvalue Problem II,*
    Nicolas Ressayre
    ANNALES DE L'INSTITUT FOURIER, **61** (4), p. 1467–1491, 2011.

25. *Branching Schubert Calculus and Belkale-Kumar Product on Cohomology,*
    Edward Richmond, **Nicolas Ressayre**
    PROC. AMS, **139**, pages 835-848, 2011.

26. *Geometric Invariant Theory and Generalized Eigenvalue Problem,*
Nicolas Ressayre
Inventiones Mathematicae, **180**, pages 389–441, 2010.

27. *Spherical homogeneous spaces of minimal rank,*
Nicolas Ressayre
Advances in Math, **224**, issue 5, pages 1784-1800, 2010.

28. *Lattice Polytopes and Root Systems,*
Pierre-Louis Montagard, **Nicolas Ressayre**
Bull. London Math Society, **41**(2), pages 227–241, 2009.

29. *Invariant deformations of orbit closures in $\mathfrak{sl}(n)$,*
S Jansou, **Nicolas Ressayre**
Representation Theory, **13**, pages 50–62, 2009.

30. *Sur des faces du LR-cône généralisé,*
Pierre-Louis Montagard, **Nicolas Ressayre**
Bulletin de la SMF **135**, *no. 3*, pages 343–365, 2007.

31. *Adjacency of Young tableaux and the Springer fibers,*
Jean Pagnon, **Nicolas Ressayre**
Selecta Mathetica, New series, **12**, *no. 3-4*, pages 517-540, 2006.

32. *About Knop's action of the Weyl group on the set of orbits of a spherical subgroup in the flag manifold,*
Nicolas Ressayre
Transformation Groups, **10**, *no. 2*, pages 255-265, 2005.

33. *Balanced configurations of $2n+1$ plane vectors,*
Nicolas Ressayre
Journal of Combinatorics Algebra, **21**, *no. 3*, pages 281–287, 2005.

34. *A quadratic born for the Determinant and Permanent problem,*
Thierry Mignon, **Nicolas Ressayre**
Intern. Math Research Notices (IMRN), **79**, pages 4241–4254, 2004.

35. *Sur les orbites d'un sous-groupe sphérique dans la variété des drapeaux,*
Nicolas Ressayre
Bulletin de la SMF, **132**, pages 543–567, 2004.

36. *Quotients of group completions by spherical subgroups,*
Nicolas Ressayre
J. of Algebra, **265**, pages 1–44, 2003.

37. *The GIT-equivalence for G-line bundles,*
Nicolas Ressayre
Geom. Dedicata, **81** *no.1-3*, 295–324, 2000.

38. *Appendix: an example of a thick wall,*
Nicolas Ressayre
Pub. Math. IHES, **87** 53–56, 1998, Appendix to a Dolgachev-Hu's paper.

Submitted Preprints

39. *Intersection multiplicity one for the Belkale-Kumar product in G/B*,
Luca Francone, **Nicolas Ressayre**.

40. *Bidilation of small Littlewood-Richardson coefficients*,
Pierre-Emmanuel Chaput, **Nicolas Ressayre**. To appear in REPRESENTATION THEORY.

Preprints

41. *A parametric non generic Richardson variety in the cominuscule case*,
Pierre-Emmanuel Chaput, **Nicolas Ressayre**.

In Preparation

42. *An Algorithm to compute the Kronecker cone*,
Bulois Micahel, Denis Roland, **Nicolas Ressayre**.

43. *On relative semi-stability*,
Paul-Emile Paradan, **Nicolas Ressayre**.

44. *The moment cone of an affine G-variety*,
Paul-Emile Paradan, **Nicolas Ressayre**.

45. *The moment cone of an affine G-variety with involution*,
Paul-Emile Paradan, **Nicolas Ressayre**.

1. *Tensor semigroup of affine KM Lie algebras*,
   Journal of the AMS, **35** (2022), no. 2, 309--360.

   Abstract: In this work, we prove a Brown-Kumar conjecture that describes the asymptotic support of the decomposition of the tensor product of integrable representations of highest weight for an affine Kac-Moody algebra.

   In my opinion, three factors make this work valuable: 1- We introduce a new method to study the very classical Horn problem. A method that allows us to redemonstrate without using the Hilbert-Mumford theorem or the notion of semi-stability, the description of the Horn cone for the group $U_n(\mathbb{C})$. 2- The infinite dimension induces significant technical complications that had to be overcome. 3- We solve a Kumar conjecture on a subject for which he is recognized as the world specialist.

   As a bonus, we exhibit, for each type, an explicit saturation constant. In finite dimension, the semigroup, support of the tensor product, is of finite type, ensuring the existence, a priori, of such constants. For an affine algebra, this existence was not assured a priori.

2. *On the faces of the tensor cone of symmetrizable Kac-Moody Lie algebras*, With Shrawan Kumar
   To appear in Ann. Sci. ENS, 50 pp.

   Abstract: We show here that each inequality of the Brown-Kumar conjecture induces a codimension one face of the tensor cone for any symmetrizable Kac-Moody algebra. If the general approach follows my proof published in Inventiones in the case of finite-dimensional algebras, the infinite dimension induces considerable complications in the geometric arguments.

3. *A generalization of the Fulton conjecture for arbitrary groups*,
   with P. Belkale et S. Kumar
   Mathematsche Annalen, 354 (2), pages 401-4251, 2012.

   Abstract: Given three partitions λ, μ and ν, we denote by $c_{\lambda,\mu}^{\nu}$ the Littlewood-Richardson coefficient. On the one hand, these coefficients encode the decomposition of the tensor product of representations for the linear group. On the other hand, they are the structure coefficients of the cup product on the cohomology ring of Grassmannians. The following result had been conjectured by Fulton and was shown by Knutson-Tao:

   $$c_{\lambda,\mu}^{\nu} = 1 \quad \Rightarrow \quad c_{n\lambda,n\mu}^{n\nu} = 1,$$

   for any positive integer n.

   We show here a generalization of this conjecture that relates the theory of the intersection of any flag variety to the multiplicities of the decomposition of tensor products. Let G be a complex semisimple group, P a parabolic subgroup of G and L a Levi subgroup of P. More precisely, we show that if a Levi-mobile structure coefficient of the cohomology of G/P is equal to one then a half-line of multiplicities for the decomposition of the tensor product of simple L-modules is equal to one.

   In the case where G is equal to SL_n, we thus obtain a new proof of Fulton's conjecture, in which the two interpretations of the Littlewood-Richardson coefficients play very different roles.

4. *Two generalizations of the PRV conjecture,*
   with Pierre-Louis Montagard et Boris Pasquier,

   Abstract: Let G be a reductive and connected complex group. The PRV conjecture, which was proved independently in 1989 by S. Kumar and O. Mathieu, provides explicit irreducible submodules in the tensor product of two simple G-modules. More precisely, let $V_G(\mu)$ and $V_G(\nu)$ be two simple G-modules of highest weights μ and ν respectively. Then, for any element w of the Weyl group W of G, the simple G-module $V_G(\overline{\mu + w\nu})$ of highest weight $\mu + w\nu$ appears with multiplicity at least one in $V_G(\mu) \otimes V_G(\nu)$.

   This paper achieves three goals. First, we simplify Shrawan Kumar's proof of the PRV conjecture. We also generalize the PRV conjecture to other restriction problems. Finally, we improve the PRV conjecture by explaining new components of $V_G(\mu) \otimes V_G(\nu)$.

5. *Geometric Invariant Theory and the Generalized Eigenvalue Problem,*

   Abstract: Let G be a connected reductive subgroup of a complex and reductive connected group $\hat{G}$.

   Let us fix maximal tori and Borel subgroups of G and $\hat{G}$ such that the irreducible modules are parametrized by their highest weights. The pairs $(\nu, \hat{\nu})$ of dominant weights such that $V_G(\nu)^*$ is a submodule of $V_{\hat{G}}(\hat{\nu})$ form a monoid of finite type. The description of the polyhedral convex cone $\mathbb{Q}_{\geq 0} \mathcal{S}(G, \hat{G})$ generated by this semigroup is a very rich subject whose history goes back to a work by Herman Weyl in 1912.

   Here we describe the minimal set of inequalities that characterizes the cone $\mathbb{Q}_{\geq 0} \mathcal{S}(G, \hat{G})$ as a part of the dominant chamber. In other words, we bijectively parameterize the codimension 1 faces of $\mathbb{Q}_{\geq 0} \mathcal{S}(G, \hat{G})$ that meet the interior of the dominant chamber.

   The obtained proof of the minimality of the list of inequalities is our major result here. The only previously known case was that of the tensor product for the linear group which had been shown 6 years before by Knutson-Tao-Woodward with totally different methods.