ALLEGATO A

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Lorenzo Mazzieri

CURRICULUM VITAE

INFORMAZIONI PERSONALI (NON INSERIRE INDIRIZZO PRIVATO E TELEFONO FISSO O CELLULARE)

COGNOME	**MAZZIERI**
NOME	**LORENZO**
DATA DI NASCITA	01/05/1980

CURRICULUM VITÆ OF LORENZO MAZZIERI

PERSONAL INFORMATION AND CONTACTS

- Place and Date of birth: Parma, 1st of May 1980
- Citizenship: Italian
- Marital status: married, 2 children
- Institution: Università degli Studi di Trento
- Address: via Sommarive 14, 38123 Povo (TN) - ITALY
- Office: 276 Phone: +39.0461.281672 E-mail: lorenzo.mazzieri@unitn.it

ACADEMIC POSITIONS

- **March 2011 - August 2015:** Ricercatore in Mathematical Analysis (MAT/05) at Scuola Normale Superiore of Pisa. New sector: 01/A3.
- **Since September 2015:** Associate Professor in Mathematical Analysis (MAT/05) at University of Trento. New sector: 01/A3.

ACADEMIC QUALIFICATIONS

- National qualification as Professore Ordinario in Geometry and Algebra. Sector: 01/A2. Validity: 30/11/2017 – 30/11/2023.
- National qualification as Professore Ordinario in Mathematical Analysis and Probability. Sector: 01/A3. Validity: 10/05/2019 – 10/05/2025.

ISTITUTIONAL RESPONSIBILITIES

- **2013-2016:** Member of the Collegio di Dottorato for the PhD program in Mathematics at SNS.
- **Since 2016** Member of the Collegio di Dottorato for the PhD program in Mathematics at Università degli studi di Trento.

EDUCATION AND POSTDOCTORAL RESEARCH EXPERIENCES

- **July 2004.** Degree with merits in Mathematics at University of Parma (ITALY).
- **January 2005 - December 2007.** Ph.D. fellowship in Mathematics at Scuola Normale Superiore of Pisa (ITALY).
- **January 2008.** Ph.D. cum laude in Mathematics at Scuola Normale Superiore of Pisa and Université Paris 12. Joint supervision program between Scuola Normale Superiore of Pisa (ITALY) and Université Paris 12 (FRANCE).
- **February 2008 - September 2009.** Junior Scientist at Max Plank Institut für Gravitationsphysik - Albert Einstein Institut of Potsdam (GERMANY), in the division *Geometric Analysis and Gravitation*, directed by prof. G. Huisken.
- **October 2009 - October 2010.** Research contract at Scuola Internazionale Superiore di Studi Avanzati of Trieste (ITALY), in the division *Functional Analysis*. Research contract supported by the the research program *FIRB-IDEAS Analysis and Beyond*, directed by prof. A. Malchiodi.
- **November 2010 - February 2011.** CRM Junior visiting position at Centro di ricerca matematica Ennio De Giorgi of Pisa (ITALY), directed by prof. M. Giaquinta (1st ranked in the selection process among 131 candidates).

HONORS AND PRIZES

Prix de thèse 2009 d'Université Paris-Est, Département de Mathématiques, Sciences et Techniques de l'Information et de la Communication (MSTIC) for the Ph.D. Thesis: *Somme connesse generalizzate per problemi della geometria / Sommes connexes généralisées pour des problèmes issus de la géométrie*. Advisor: Prof. F. Pacard, Co-advisor: Prof. G. Tomassini.

RESEARCH INTERESTS

Geometric aspects of partial differential equations, Geometric flows with special regard for self-similar solutions, Overdetermined boundary value problems, Nonlinear problems in Riemannian and conformal geometry, Mathematical aspects of General Relativity.

RESEARCH PROJECTS DEVISED AND MANAGED

- **Member** of the *GNAMPA PROJECT 2019 – Aspetti geometrici in teoria del potenziale lineare e nonlineare* Principal Investigator: Dott. Virginia Agostiniani. Duration of the project: 12 months.
- **Member** of the *GNAMPA PROJECT 2017 – Problemi sovradeterminati e questioni di ottimizzazione di forma*. Principal Investigator: Prof. Ilaria Fragalà. Duration of the project: 12 months.
- **Member** of the *GNAMPA PROJECT 2016 – Principi di fattorizzazione, formule di monotonia e disuguaglianze geometriche*. Principal Investigator: Dr. Virginia Agostiniani. Duration of the project: 12 months.
- **Principal Investigator** of the *SNS GRANT 2013 – Geometric flows and related topics*. Amount of the grant: 24.500. Duration of the project: 24 months.
- **Principal Investigator** of the *GNAMPA PROJECT 2012 – Flussi geometrici e soluzioni autosimilari*. Amount of the grant: 3.500. Duration of the project: 12 months.
- **Member** of the *PRIN PROJECT 2012 – Calcolo delle Variazioni*. Principal Investigator: Prof. Gianni Dal Maso. Duration of the projects: 36 months.
- **Member** of the *FUTURO IN RICERCA PROJECT 2012 – Geometria Differenziale e Teoria Geometrica delle funzioni*. Principal investigator: Dr. Caterina Stoppato. Duration of the project: 48 months.
- **Member** of the *FIRB PROJECT 2009 – Analysis and Beyond*. Principal Investigator: Prof. Andrea Malchiodi. Duration of the project: 48 months.

SUPERVISION OF Ph.D. STUDENTS

- **May 2014 – January 2018.** Dr. Stefano Borghini – Perfezionamento in Matematica at SNS of Pisa (ITALY).
- **September 2014 – October 2018.** Dr. Samuele Lancini – Perfezionamento in Matematica at SNS of Pisa (ITALY). Co-supervision in collaboration with Prof. Claudio Arezzo (ICTP-Trieste).
- **Since November 2016:** Dr. Mattia Fogagnolo – Dottorato in Matematica at University of Trento (ITALY).
- **Since November 2018:** Dr. Luca Benatti – Dottorato in Matematica at University of Trento (ITALY).

SUPERVISION OF MASTER THESIS

- **March 2016.** Felix Dietrich – Eberhard Karls Universität Tübingen (GERMANY) and Università degli Studi di Trento (ITALY). Co-supervision in collaboration with Prof. Gerhard Huisken (Eberhard Karls Universität -Tübingen).
- **July 2016.** Francesco Chini – Università degli Studi di Trento (ITALY).

ORGANIZATION OF SCIENTIFIC CONFERENCES

– Member of the organizing committee of the conference *Ricci Solitons Days* at CRM Ennio De Giorgi of Pisa (ITALY), 2011.

– Member of the organizing committee of the conference *ICTP School on Geometry and Gravity* at ICTP of Trieste (ITALY), 2019.

INVITED SPEAKER TO THE FOLLOWING CONFERENCES

– *Analysis and geometric singularities*. Oberwolfach, GERMANY, 2007.
– *Loss of compactness in nonlinear PDE: recent trends*. BIRS Banff, CANADA, 2007.
– *Scalar curvature and semilinear PDE in geometry and topology*. Regensburg, GERMANY, 2008.
– *Séminaire commun d'analyse géométrique*. CIRM Marseille, FRANCE, 2008.
– *Séminaire commun d'analyse géométrique*. CIRM Marseille, FRANCE, 2009.
– *Geometric flows and geometric operators*. CRM E. De Giorgi, Pisa, ITALY, 2009.
– *Ecole d'été Franco-Chinoise*. Beijing University, CHINA, 2009.
– *Geometric Analysis*. CIRM Marseille, FRANCE, 2011.
– *Geometric PDE*. IHP Paris, FRANCE, 2012.
– *XXIII Convegno Nazionale di Calcolo delle Variazioni*. Levico Terme, ITALY, 2013.
– *FIRB meeting Geometria Differenziale e Teoria Geometrica delle Funzioni*. Firenze, ITALY, 2013.
– *Geometric Analysis and Relativity*. Hefei, CHINA, 2014.
– *XXVI Convegno Nazionale di Calcolo delle Variazioni*. Levico Terme, ITALY, 2016.
– *France-Italy meeting in Geometric Analysis*. CRM E. De Giorgi, Pisa, ITALY, 2017.
– *Geometric analysis in smooth and non-smooth spaces*. SISSA, Trieste, ITALY, 2017.
– *Advances in General Relativity*. ESI, Vienna, AUSTRIA, 2017.
– *Recent Advances in Geometric Analysis*. CRM E. De Giorgi, Pisa, ITALY, 2018.
– *Nonlinear PDE in Geometry and Physics*. Cortona, ITALY, 2018.
– *XXIX Convegno Nazionale di Calcolo delle Variazioni*. Levico Terme, ITALY, 2019.
– *Nonlinear Geometric PDE's*. BIRS, Banff, CANADA, 2019.

RESEARCH SEMINARS AND VISITS AT THE FOLLOWING INSTITUTIONS

– University of Washington, Seattle (USA) – Stanford University, Palo Alto (USA) – Università degli Studi di Parma, Parma (ITALY) – Université de Nice, Nice (FRANCE) – Max Plank Institut für Gravitationsphysik - Albert Einstein Institut di Potsdam (GERMANY) – Université d'Avignon (FRANCE) – Université de Tours (FRANCE) – Università degli studi di Pavia (ITALY) – Universitat Politécnica de Catalunya (SPAIN) – Eberhard Karls Universität of Tuebingen (GERMANY) – University of Warwick (UK) – Université de Aix-Marseille (FRANCE) – Oxford Centre for Nonlinear PDE's (UK) – Università di Roma 2 Tor Vergata (ITALY) – Università degli studi di Trento (ITALY) – Università di Napoli Federico II (ITALY) – University of Vienna (AUSTRIA) – SISSA Trieste (ITALY) – WIAS Berlin (GERMANY) – ICTP Trieste (ITALY) – ICMAT Madrid (SPAIN) – SNS Pisa (ITALY) – University of Potsdam (GERMANY)

REFEREEING ACTIVITY

Reviewer for the following scientific journals:

- Annali della Scuola Normale Superiore
- Annali di Matematica Pura e Applicata
- Calculus of Variations and Partial Differential Equations
- Communication in Contemporary Mathematics
- Communications in Mathematical Physics
- Communicatons in Analysis and Geometry
- Indiana University Mathematics Journal
- Inventiones Mathematicae
- Journal of Geometry and Physics
- Manuscripta Mathematica
- The Journal of Geometric Analysis
- Rendiconti del Seminario Matematico della Università di Padova

TEACHING

- **Academic Year 2009-2010.**
  - *Complements of Measure Theory*, for master degree students at SISSA.
- **Academic Year 2010-2011.**
  - *Complements of Functional Analysis*, for master degree students at SISSA.
- **Academic Year 2011-2012.**
  - *Introduction to Riemannian Geometry*, in collaboration with dr. Carlo Mantegazza, for master degree and Ph.D. students at SNS.
- **Academic Year 2012-2013.**
  - Member of the selection committee for the 1^{st} year entrance examination at SNS's Classe di Scienze.
  - *Selected topics in Riemannian Geometry*, in collaboration with dr. Carlo Mantegazza, for master degree and Ph.D. students at SNS.
  - *Introduction to Measure Theory and Functional Analysis*, exercices and complements, main lecturer: prof. L. Ambrosio, for 3^{rd} year students at SNS.
- **Academic Year 2013-2014.**
  - Member of the selection committee for the 4^{th} year entrance examination at SNS's Classe di Scienze.
  - *Riemannian Geometry*, in collaboration with dr. Carlo Mantegazza, for master degree and Ph.D. students at SNS.
  - *Mathemtical methods for Chemistry*, for 3^{rd} year students at SNS.
- **Academic Year 2014-2015.**
  - *Riemannian Geometry*, in collaboration with dr. Carlo Mantegazza, for master degree and Ph.D. students at SNS.
  - *Complementary topics of Mathematics*, exercices and complements, main lecturer: prof. L. Ambrosio, for 1^{st} year students at SNS.
- **Academic Year 2015-2016.**
  - *Calculus 2*, for 2^{nd} year students at the Department of civil, environmental and mechanical engineering of the University of Trento.
  - *Complements of Mathematical Analysis*, for 2^{nd} year students at the Department of civil, environmental and mechanical engineering of the University of Trento.
  - *Advanced Topics in Analysis*, for master students at the Department of Mathematics of the University of Trento.
- **Academic Year 2016-2017.**
  - *Calculus 2*, for 2^{nd} year students at the Department of civil, environmental and mechanical engineering of the University of Trento.
  - *Geometric Analysis*, for master and Ph.D. students at the Department of Mathematics of the University of Trento.
- **Academic Year 2017-2018.**
  - *Calculus 2*, for 2^{nd} year students at the Department of civil, environmental and mechanical engineering of the University of Trento.
  - *Attività di Laboratorio/Seminario*, for 3^{rd} year students students at the Department of Mathematics of the University of Trento.
- **Academic Year 2018-2019.**
  - *Calculus 2*, for 2^{nd} year students at the Department of civil, environmental and mechanical engineering of the University of Trento.
  - *Geometric Analysis*, for master and Ph.D. students at the Department of Mathematics of the University of Trento.

LIST OF PUBLICATIONS (with abstracts)

1. L. Mazzieri – **Generalized connected sum construction for nonzero constant scalar curvature metrics** *(Communication in Partial Differential Equations, 33 (2008), Issue 1, 1–17)*.

ABSTRACT. In this paper we consider the problem of constructing solutions to the Yamabe equation on the generalized connected sum $M = M_1 \sharp_K M_2$ of two compact Riemannian manifolds (M_1, g_1) and (M_2, g_2) along a common isometrically embedded submanifold (K, g_K) of codimension ≥ 3. We are able to perform this generalized connected sum under the assumptions that the two initial Riemannian metrics have the same constant scalar curvature S and the linearized Yamabe operators about the metrics g_i, namely the operators $\Delta_{g_i} + S/(m-1)$, have trivial kernels, for $i = 1, 2$. The structure of the metrics obtained is investigated and described. This result is a generalization of the analogous result by D. Joyce for the connected sums at points.

2. L. Mazzieri – **Generalized connected sum construction for scalar flat metrics** *(Manuscripta Mathematica, 129 (2009), Issue 2, 137–168)*.

ABSTRACT. In this paper we show that the generalized connected sum construction for nonzero constant scalar curvature metrics can be extended to the zero scalar curvature case. In particular we construct solutions to the Yamabe equation on the generalized connected sum $M = M_1 \sharp_K M_2$ of two compact Riemannian manifolds (M_1, g_1) and (M_2, g_2) with zero constant scalar curvature along a common isometrically embedded submanifold (K, g_K) of codimension ≥ 3. We present two kinds of construction. The first one is the basic model and it works for every couple of scalar flat manifolds, but it has a drawback. In fact, using this method, we are not allowed to choose a scalar flat metric on the generalized connected sum, although the error can be chosen as small as we want. The second construction is an adjustment of the first one which enable us to get a zero scalar curvature metric on the final manifold, but it requires the hypothesis that the starting Riemannian manifolds are non Ricci flat. As a consequence of the second result, we produce a generalized gluing construction for time symmetric initial data sets in the contest of the Einstein constraint equations.

3. L. Mazzieri – **Generalized gluing for Einstein constraint equations** *(Calculus of Variations and Partial Differential Equations, 34 (2009), Issue 4, 453–473)*.

ABSTRACT. In this paper we construct a family of new solutions to the Einstein constraint equations by performing the generalized connected sum of two given compact m-dimensional constant mean curvature solutions (M_1, g_1, Π_1) and (M_2, g_2, Π_2) along a common isometrically embedded k-dimensional sub-manifold (K, g_K). Away from the gluing locus the metric and the second fundamental form of the new solutions can be chosen as close as desired to the ones of the original solutions. The proof is essentially based on the conformal method and the geometric construction produces a polyneck between M_1 and M_2 whose metric is modeled fiber-wise (i.e., along the slices of the normal fiber bundle of K) around a Schwarzschild metric. For these reasons the codimension $n = m - k$ of K in M_1 and M_2 is required to be ≥ 3. In this sense our result is a generalization of the Isenberg-Mazzeo-Pollack gluing, which works for connected sum at points and in dimension 3. The solutions obtained for the Einstein constraint equations can be used to produce new short time vacuum solutions of the Einstein system on a Lorentzian $(m+1)$-dimensional manifold, as guaranteed by a well known result of Choquet-Bruhat.

4. G. Catino and L. Mazzieri – **Connected sum construction for σ_k-Yamabe metrics** *(Journal of Geometric Analysis, 23 (2013), no.2, 812–854)*.

ABSTRACT. We show that the connected sum of two compact n-dimensional Riemannian manifolds (M_1, g_1) and (M_2, g_2), carrying metrics with positive constant σ_k-curvature, can be endowed with a family of new metrics which also have constant σ_k-curvature, provided $2 \leq 2k < n$ and the metrics g_1 and g_2 satisfy a natural non-degeneracy condition. Moreover, the final metrics $\tilde{g}_\varepsilon$, where ε represents the neck size parameter, are conformal to the starting ones away from the gluing locus and the conformal factor tends to the constant 1, as $\varepsilon \to 0$.

5. G. Catino, C. Mantegazza, L. Mazzieri and M. Rimoldi – **Locally conformally flat quasi–Einstein manifolds** *(Journal für die reine und angewandte Mathematik, 2013 (2013), Issue 675, 181–189)*.

ABSTRACT. In this paper we prove that any complete locally conformally flat quasi-Einstein manifold of dimension $n \geq 3$ is locally a warped product with $(n-1)$-dimensional fibers of constant curvature. This result includes also the case of locally conformally flat gradient Ricci solitons.

6. L. Mazzieri and A. Segatti – **Constant σ_k-curvature metrics with Delaunay type ends** *(Advances in Mathematics, 229 (2012), Issue 6, 3147–3191)* .

ABSTRACT. Extending the techniques developed for the connected sum of compact σ_k-Yamabe, we glue together several Delaunay-type solutions. These are complete periodic metrics on the cylinder $\mathbb{R} \times \mathbb{S}^{n-1}$ with constant σ_k-curvature. Our solutions are conformally flat, hence they can be seen as singular solutions to the σ_k-Yamabe problem on the complement of an even number of points on $\mathbb{S}^n$. Again the condition $2 \leq 2k < n$ is necessary. This construction extends to the fully nonlinear case a result previously obtained by Mazzeo, Pollack and Uhlenbeck for $k = 1$, when the σ_k-curvature is a constant multiple of the ordinary scalar curvature.

7. G. Catino, C. Mantegazza and L. Mazzieri – **On the global structure of conformal gradient solitons with nonnegative Ricci tensor** *(Commun. Contemp. Math. 14, 1250045 (2012) [12 pages] DOI:10.1142/S0219199712500459)*.

ABSTRACT. In this paper we prove that any complete conformal gradient soliton with nonnegative Ricci tensor is either isometric to a direct product $\mathbb{R} \times N^{n-1}$, or globally conformally equivalent to the Euclidean space $\mathbb{R}^n$ or to the round sphere $\mathbb{S}^n$. In particular, we show that any complete, noncompact, gradient Yamabe-type soliton with positive Ricci tensor is rotationally symmetric, whenever the potential function is nonconstant.

8. H.-D. Cao, G. Catino, Q. Chen, C. Mantegazza and L. Mazzieri – **Bach flat gradient steady Ricci solitons** *(Calculus of Variations and Partial Differential Equations, 49 (2014), Issue 1-2, 125–138)*.

ABSTRACT. In this paper we prove that any n-dimensional, $n \geq 4$, complete Bach-flat gradient steady Ricci soliton with positive Ricci curvature is isometric to the Bryant soliton. We also show that a three-dimensional gradient steady Ricci soliton with divergence-free Bach tensor is either flat or isometric to the Bryant soliton. In particular, these results improve the corresponding classification theorems for complete locally conformally flat gradient steady Ricci solitons.

9. E. Delay and L. Mazzieri – **Refined gluing for Einstein constraint equations** *(Geometriae Dedicata, 173 (2014), Issue 1, 393–415)*.

ABSTRACT. We first show that the generalized gluing procedure of the second author for compact initial data sets can be extended to the Asymptotically Euclidean and to the Asymptotically Hyperbolic context. This procedure is based on the conformal method and then it involves global perturbations of the original metrics. In the second part of the paper, we refine these results by showing that in any case, and generically, the gluing can be localized. This yields new solutions to the Einstein constraint equations, which perfectly agree with the original ones away from a neighborhood of the gluing locus.

10. M. Gonzalez and L. Mazzieri – **Singularities for a fully non-linear elliptic equation in conformal geometry** *(Bulletin of the Institute of Mathematics Academia Sinica (New Series), special issue in honor of Prof. Neil Trudinger, 9 (2014), No. 2, 223-244)*.

ABSTRACT. We construct some radially symmetric solutions of the constant σ_k-equation on $\mathbb{R}^n \setminus \mathbb{R}^p$, which blow up exactly at the submanifold $\mathbb{R}^p \subset \mathbb{R}^n$. These are the basic models to the problem of finding complete metrics of constant σ_k–curvature on a general subdomain of the sphere $\mathbb{S}^n \setminus \Lambda^p$ that blow up exactly at the singular set Λ^p and that are conformal to the

canonical metric. More precisely, we look at the case $k = 2$ and $0 < p < \mathfrak{p}_2 := (n - \sqrt{n} - 2)/2$. The main result is the understanding of the precise asympthotics of our solutions near the singularity and their decay away from the singularity. The first aspect will insure the completeness of the metric about the singular locus, whereas the second aspects will guarantee that the model solutions can be locally transplanted to the original metric on $\mathbb{S}^n$, and hence they can be used to deal with the general problem on $\mathbb{S}^n \backslash \Lambda^p$.

11. G. Catino, C. Mantegazza and L. Mazzieri – **A note on Codazzi tensors** *(Mathematische Annalen, 362 (2015), Issue 1, 629–638)*.

ABSTRACT. We discuss a gap in A. Besse's book, recently pointed out by G. Merton, which concerns the classification of Riemannian manifolds admitting a Codazzi tensors with exactly two distinct eigenvalues. For such manifolds, we prove a structure theorem, without adding extra hypotheses and then we conclude with some applications of this theory to the classification of three-dimensional gradient Ricci solitons.

12. G. Catino, L. Mazzieri and S. Mongodi – **Rigidity of gradient Einstein shrinkers** *(Commun. Contemp. Math. 17, 1550046 (2015) [18 pages] DOI:10.1142/S0219199715500467)*.

ABSTRACT. In this paper we consider a perturbation of the Ricci solitons equation proposed by J. P. Bourguignon and studied by the first two authors in the steady case and we classify noncompact gradient shrinkers with bounded nonnegative sectional curvature.

13. G. Catino, C. Mantegazza and L. Mazzieri – **Locally conformally flat ancient Ricci flows** *(Analysis & PDE, 8 (2015), No. 2, 365–371)*.

ABSTRACT. We show that any locally conformally flat ancient solution to the Ricci flow must be rotationally symmetric. As a by-product, we prove that any locally conformally flat Ricci soliton is a gradient soliton in the shrinking and steady cases as well as in the expanding case, provided the soliton has nonnegative curvature.

14. V. Agostiniani and L. Mazzieri – **Riemannian aspects of potential theory** *(Journal de Mathématiques Pures et Appliquées, 104 (2015), Issue 3, 561–586)*.

ABSTRACT. In this paper we provide a new method for establishing the rotational symmetry of the solutions to a couple of very classical overdetermined problems arising in potential theory, in both the exterior and the interior domain. Thanks to a conformal reformulation of the problems, we obtain Riemannian manifolds with zero Weyl tensor satisfying a quasi-Einstein type equation. Exploiting these geometric properties, we conclude via a splitting argument that the manifolds obtained are half cylinders. In turn, the rotational symmetry of the potential is implied.

15. G. Catino and L. Mazzieri – **Gradient Einstein solitons** *(Nonlinear Analysis, 132 (2016), 66–94)*.

ABSTRACT. In this paper we consider a perturbation of the Ricci solitons equation proposed by J. P. Bourguignon. We show that these structures are more rigid then standard Ricci solitons. In particular, we prove that there is only one complete three-dimensional, positively curved, Riemannian manifold satisfying

$$\mathrm{Ric} - \frac{1}{2}\mathrm{R}\, g + \nabla^2 f = 0\,,$$

for some smooth function f. This solution is rotationally symmetric and asymptotically cylindrical and it represents the analogue of the Hamilton's cigar in dimension three. The key ingredient in the proof is the rectifiability of the potential function f. It turns out that this property holds also in the Lorentzian setting and for a more general class of structures, which includes some gravitational theories.

16. C. Arezzo, R. Lena and L. Mazzieri – **On the resolution of extremal and constant scalar curvature Kähler orbifolds** *(International Mathematics Research Notices, Volume 2016 (2016), Number 21, 6415–6452, DOI:10.1093/imrn/rnv346)*.

ABSTRACT. Given a compact constant scalar curvature Kähler orbifold of complex dimension $m \geq 2$ with nontrivial holomorphic vector fields, we find sufficient conditions on the position of the singular points for the manifold to admit a constant scalar curvature Kähler desingularization. This generalizes the results obtained by the first author with F. Pacard for the blow-up of smooth points. We also treat the case of extremal metrics.

17. V. Agostiniani and L. Mazzieri – **Comparing monotonicity formulas for electrostatic potentials and static metrics** *(Rend. Lincei Mat. Appl. 28 (2017), 7–20. DOI:10.4171/ RLM/749).*

ABSTRACT. In this note we survey and compare the monotonicity formulas recently discovered by the authors in the context of classical potential theory and in the study of static metrics, respectively. In both cases we discuss the most significant implications of the monotonicity formulas in terms of sharp analytic and geometric inequalities. In particular, we derive the classical Willmore inequality for smooth compact hypersurfaces embedded in Euclidean space and the Riemannian Penrose inequality for static Black Holes with connected horizon.

18. G. Catino, L. Cremaschi, Z. Djadli, C. Mantegazza and L. Mazzieri – **The Ricci-Bourguignon flow.** *(Pacific Journal of Mathematics 287-2 (2017), 337–370, DOI 10.2140/pjm.2017.287.337).*

ABSTRACT. In this paper we present some results on a family of geometric flows introduced by J. P. Bourguignon that generalize the Ricci flow. For suitable values of the scalar parameter involved in these flows, we prove short time existence and provide curvature estimates. We also state some results on the associated solitons.

19. V. Agostiniani and L. Mazzieri – **On the geometry of the level sets of bounded static potentials.** *(Communications in Mathematical Physics, v. 2017, (2017), pp. 261–301, DOI: 10.1007/s00220-017-2922-x).*

ABSTRACT. In this paper we present a new approach to the study of asymptotically flat static metrics arising in general relativity. In the case where the static potential is bounded, we introduce new quantities which are proven to be monotone along the level set flow of the potential function. We then show how to use these properties to detect the rotational symmetry of the static solutions, deriving a number of sharp inequalities. As a consequence of our analysis, a simple proof of the classical 3-dimensional Black Hole Uniqueness Theorem is recovered and some geometric conditions are discussed under which the same statement holds in higher dimensions.

20. S. Borghini and L. Mazzieri – **On the mass of static metrics with positive cosmological constant - I** *(Classical and Quantum Gravity 35 (2018), DOI: https://doi.org/10.1088/1361-6382/aac081).*

ABSTRACT. In this paper we propose and discuss a notion of mass for compact static metrics with positive cosmological constant. As a consequence, we characterise the de Sitter solution as the only static vacuum metric with zero mass. Finally, we show how to adapt our analysis to the case of negative cosmological constant, leading to a uniqueness theorem for the Anti de Sitter spacetime.

21. S. Borghini, G. Mascellani and L. Mazzieri – **Some sphere theorems in linear potential theory** *(Trans. Amer. Math. Soc. 371 (2019), pp. 7757–7790, DOI:10.1090/tran/7637).*

ABSTRACT. In this paper we analyze the capacitary potential due to a charged body in order to deduce sharp analytic and geometric inequalities, whose equality cases are saturated by domains with spherical symmetry. In particular, for a regular bounded domain $\Omega \subset \mathbb{R}^n$, $n \geq 3$, we prove that if the mean curvature H of the boundary obeys the condition

$$-\left[\frac{1}{\mathrm{Cap}(\Omega)}\right]^{\frac{1}{n-2}} \leq \frac{H}{n-1} \leq \left[\frac{1}{\mathrm{Cap}(\Omega)}\right]^{\frac{1}{n-2}},$$

then Ω is a round ball.

22. M. Fogagnolo, L. Mazzieri and A. Pinamonti – **Geometric aspects of p–capacitary potentials** *(Annales de l'Institut Henri Poincaré C, Analyse Non Linéaire, Volume 36, Issue 4, July 2019, pp. 1151–1179, DOI: 10.1016/j.anihpc.2018.11.005)*.

ABSTRACT. We provide monotonicity formulas for solutions to the p–Laplace equation defined in the exterior of a convex domain. A number of analytic and geometric consequences are derived, including the classical Minkowski inequality as well as new characterizations of rotationally symmetric solutions and domains. The proofs rely on the conformal splitting technique introduced by the second author in collaboration with V. Agostiniani.

23. C. Arezzo, A. Della Vedova, R. Lena and L. Mazzieri – **On the Kummer construction for Kcsc metrics** *(Boll. Unione Mat. Ital. (2019), pp. 12–83. DOI: 10.1007/s40574-018-0170-4)*.

ABSTRACT. Given a compact constant scalar curvature Kähler orbifold, with nontrivial holomorphic vector fields, whose singularities admit a local ALE Kähler Ricci-flat resolution, we find sufficient conditions on the position of the singular points to ensure the existence of a global constant scalar curvature Kähler desingularization. We also give complete proofs of a number of analytic results which have been used in this context by various authors. A series of explicit examples is discussed.

24. S. Borghini and L. Mazzieri – **Monotonicity formulas for static metrics with non-zero cosmological constant** *(To appear in the Springer-Indam volume "Contemporary Research in Elliptic PDEs and Related Topics")*.

ABSTRACT. In this paper we adopt the approach presented in Agostiniani and Mazzieri (J. Math. Pures Appl. 104, pp. 561–586, 2015; Commun. Math. Phys. 355, pp. 261–301, 2017) to study non-singular vacuum static space-times with non-zero cosmological constant. We introduce new integral quantities, and under suitable assumptions we prove their monotonicity along the level set flow of the static potential. We then show how to use these properties to derive a number of sharp geometric and analytic inequalities, whose equality case can be used to characterize the rotational symmetry of the underlying static solutions. As a consequence, we are able to prove some new uniqueness statements for the de Sitter and the anti-de Sitter metrics. In particular, we show that the de Sitter solution has the least possible surface gravity among three-dimensional static metrics with connected boundary and positive cosmological constant.

PREPRINTS

1. V. Agostiniani, M. Fogagnolo and L. Mazzieri – **Minkowski inequalities via nonlinear potential theory** *(Preprint-2019)*.

ABSTRACT. In this paper, we prove an exended version of the Minkowski Inequality, holding for any smooth bounded subset $\Omega \subset \mathbb{R}^n$, $n \geq 3$. Our proof relies on the discovery of *effective monotonicity formulas* along the level set flow of the p-capacitary potentials associated with Ω, in the limit as $p \to 1^+$. These formulas also testify the existence of a link between the monotonicity formulas derived by Colding and Minicozzi for the level sets flow of Green's functions and the monotonicity formulas employed by Huisken, Ilmanen and several other authors in studying the geometric implications of the Inverse Mean Curvature Flow.

2. V. Agostiniani, M. Fogagnolo and L. Mazzieri – **Sharp geometric inequalities for closed hypersurfaces in manifolds with nonnegative Ricci curvature** *(Preprint-2018)*.

ABSTRACT. In this paper we consider complete noncompact Riemannian manifolds (M, g) with nonnegative Ricci curvature and Euclidean volume growth, of dimension $n \geq 3$. For every bounded open subset $\Omega \subset M$ with smooth boundary, we prove that

$$\int_{\partial\Omega} \left| \frac{\mathrm{H}}{n-1} \right|^{n-1} \mathrm{d}\sigma \;\geq\; \mathrm{AVR}(g) \left| \mathbb{S}^{n-1} \right| ,$$

where H is the mean curvature of $\partial\Omega$ and $\mathrm{AVR}(g)$ is the asymptotic volume ratio of (M, g). Moreover, the equality holds true if and only if $(M\backslash\Omega, g)$ is isometric to a truncated cone over $\partial\Omega$. An optimal version of Huisken's Isoperimetric Inequality for 3-manifolds is obtained using this result. Finally, exploiting a natural extension of our techniques to the case of parabolic manifolds, we also deduce an enhanced version of Kasue's non existence result for closed minimal hypersurfaces in manifolds with nonnegative Ricci curvature.

3. C. Arezzo, A. Della Vedova and L. Mazzieri – **K-stability, Futaki invariants and cscK metrics on orbifold resolutions** *(Preprint-2018)*.

ABSTRACT. In this paper we compute the Futaki invariant of adiabatic Kaehler classes on resolutions of Kaehler orbifolds with isolated singularities. Combined with previous existence results of extremal metrics by Arezzo-Lena-Mazzieri, this gives a number of new existence and non-existence results for cscK metrics.

4. S. Borghini and L. Mazzieri – **On the mass of static metrics with positive cosmological constant - II** *(Preprint-2017)*.

ABSTRACT. This is the second of two works, in which we discuss the definition of an appropriate notion of mass for static metrics, in the case where the cosmological constant is positive and the model solutions are compact. In the first part, we have established a positive mass statement, characterising the de Sitter solution as the only static vacuum metric with zero mass. In this second part, we prove optimal area bounds for horizons of black hole type and of cosmological type, corresponding to Riemannian Penrose inequalities and to cosmological area bounds à la Boucher-Gibbons-Horowitz, respectively. Building on the related rigidity statements, we also deduce a uniqueness result for the Schwarzschild-de Sitter spacetime.

5. V. Agostiniani and L. Mazzieri – **Monotonicity formulas in potential theory.** *(Preprint-2016)*.

ABSTRACT. Using the electrostatic potential u due to a uniformly charged body $\Omega \subset \mathbb{R}^n$, $n \geq 3$, we introduce a family of monotone quantities associated with the level set flow of u. The derived monotonicity formulas are exploited to deduce sharp geometric inequalities involving the electrostatic capacity of Ω and the mean curvature of its boundary. As a byproduct we also recover the classical Willmore inequality, characterizing the equality case in terms of rotational symmetry.

6. L. Mazzieri and C.-B. Ndiaye – **Existence of solutions for the singular σ_k-Yamabe problem** *(Preprint-2010)*.

ABSTRACT. In this paper we prove the existence of constant positive σ_k-curvature metrics which are complete and conformal to the standard metric on $S^n \setminus \Lambda$, where $\Lambda \subset S^n$ is a finite number of symmetrically balanced points of cardinality at least 2, and n, k are positive integers such that $2 \leq 2k < n$. The problem is equivalent to solving a singular fully nonlinear second order elliptic equation.

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