

VIANO COLLECTED PAPERS

VIANO COLLECTED PAPERS

Non credo ci sia una teoria cosmologica definitiva,
ma infinite ipotesi che inglobano via via le precedenti.
Lo spettacolo non finirà mai.

Tullio REGGE

Giovanni Alberto Viano, già professore di Metodi Matematici della Fisica all'Università di Genova, è deceduto a Genova il 10 novembre 2014. Dopo aver conseguito la laurea in Fisica presso l'Università degli Studi di Torino, intraprese un'esperienza di ricerca presso l'Università di Rochester, negli Stati Uniti, dove iniziò la sua amicizia e assidua collaborazione con l'eminente fisico Tullio Regge, le cui teorie Viano ha contribuito a diffondere negli ambienti di ricerca di Torino e Genova, con particolare riferimento all'introduzione nella meccanica quantistica dei poli della matrice d'urto, detti appunto "poli di Regge". Da sempre mosso da spirito propositivo, intraprendente, collaborativo, definito da taluni persino missionario, Viano è stato protagonista e promotore di un'assidua e proficua attività scientifica di ricerca legata a quella di docente universitario. Queste attività si svilupparono nell'arco di più di mezzo secolo, dando luogo a un'ingente produzione letteraria.

Questo progetto editoriale nasce dal desiderio di raccogliere ordinare e diffondere il materiale scientifico pubblicato dal professor Viano, in una prospettiva di continuità con lo spirito dell'autore. Curatore delle opere è il professor Enrico De Micheli, con il quale Viano venne a contatto già negli anni Settanta, quando il primo era ancora studente liceale e il secondo già titolare di cattedra. Alla fine degli anni Novanta, i due intrecciarono una stretta e intensa collaborazione, che proseguì senza interruzioni fino agli ultimi giorni di vita di Viano.

La collana è strutturata in 5 volumi che trattano gli altrettanti principali argomenti approfonditi da Viano nel corso della sua attività. I primi 4 libri – centrati su temi quali la teoria delle reazioni nucleari, la meccanica quantistica, le estensioni di olomorfia e il momento angolare complesso – sono logicamente connessi da ciò che rappresenta il tema centrale della sua ricerca scientifica: lo studio, lo sviluppo e l'applicazione delle proprietà di analiticità di determinati oggetti matematici. Il quinto volume raccoglie gli articoli scritti su un altro fondamentale campo di ricerca: la teoria della regolarizzazione dei problemi mal-posti.

I singoli volumi di questa collana preservano la connotazione dei materiali originali, tralasciando volutamente, per una volta, la qualità redazionale e grafica, nell'intento di raccontare, attraverso la raccolta di questi documenti storici, l'intenso percorso di ricerca scientifica a cui il professor Giovanni Alberto Viano ha dedicato la propria vita.

Holomorphic Extensions

Volume 3

Edited by
Enrico De Micheli



Copyright © MMXVI
ARACNE editrice int.le S.r.l.

www.aracneeditrice.it
info@aracneeditrice.it

via Quarto Negroni, 15
00040 Ariccia
(06) 93781065

ISBN 978-88-548-9357-3

*No part of this book may be reproduced
by print, photoprint, microfilm, microfiche, or any other means,
without publisher's authorization.*

I edition: May 2016

CONTENTS OF VOLUME 3

1. T. Regge and G.A. Viano, <i>The interpolation problem in the theory of complex angular momentum,</i> Il Nuovo Cimento Serie X 25 (4), 709-722, 1962. doi:10.1007/BF02733142	1
2. E. Albino, M. Bertero and G.A. Viano, <i>An analyticity test in the theory of complex angular momentum,</i> Il Nuovo Cimento Serie X 32 (5), 1269-1294, 1964. doi:10.1007/BF02726068	15
3. R. Fioravanti and G.A. Viano, <i>Numerical inversion of the Laplace transform by the use of Pollaczek polynomials,</i> Zeitschrift für angewandte Mathematik und Physik (ZAMP) 35 (6), 802-824, 1984. doi:10.1007/BF00945445	41
4. G.A. Viano, <i>Solution of the Hausdorff moment problem by the use of Pollaczek polynomials,</i> Journal of Mathematical Analysis and Applications 156 (2), 410-427, 1991. doi:10.1016/0022-247X(91)90406-P	65
5. E. Scalas and G.A. Viano, <i>The Hausdorff moments in statistical mechanics,</i> Journal of Mathematical Physics 34 (12), 5781-5800, 1993. doi:10.1063/1.530282	83
6. R. Fioravanti and G.A. Viano, <i>On the solution of the inverse scattering problem, at fixed energy, for the class of Yukawian potentials,</i> Journal of Mathematical Physics 36 (10), 5310-5339, 1995. doi:10.1063/1.531265	103
7. E. De Micheli and G.A. Viano, <i>Hausdorff Moments, Hardy Spaces, and Power Series,</i> Journal of Mathematical Analysis and Applications 234 (1), 265-286, 1999. doi:10.1006/jmaa.1999.6367	133

8. E. De Micheli and G.A. Viano,
On the Solution of a Class of Cauchy Integral Equations,
 Journal of Mathematical Analysis and Applications **246**(2), 520-543, 2000.
 doi:10.1006/jmaa.2000.6815 155
9. G. Cuniberti, E. De Micheli and G.A. Viano,
Reconstructing the thermal Green functions at real times from those at imaginary times,
 Communications in Mathematical Physics **216**(1), 59-83, 2001.
 doi:10.1007/s002200000324 179
10. E. De Micheli and G.A. Viano,
Holomorphic extension associated with Fourier-Legendre expansions,
 The Journal of Geometric Analysis **12**(3), 355-374, 2002.
 doi:10.1007/BF02922046 205
11. E. De Micheli and G.A. Viano,
Watson resummation of a class of Hausdorff-transformed power series,
 Journal of Mathematical Analysis and Applications **299**(2), 630-650, 2004.
 doi:10.1016/j.jmaa.2004.06.015 225
12. E. De Micheli and G.A. Viano,
Numerical recovery of location and residue of poles of meromorphic functions,
 Numerische Mathematik **117**(1), 147-183, 2011.
 doi:10.1007/s00211-010-0345-0 247
13. E. De Micheli and G.A. Viano,
Holomorphic extensions associated with series expansions,
 Forum Mathematicum **24**(6), 1269-1316, 2012.
 doi:10.1515/form.2011.104 285
14. E. De Micheli and G.A. Viano,
The interpolation formula for a class of meromorphic functions,
 Journal of Approximation Theory **168**, 33-68, 2013.
 doi:10.1016/j.jat.2013.01.001 333
15. E. De Micheli and G.A. Viano,
The expansion in Gegenbauer polynomials: A simple method for the fast computation of the Gegenbauer coefficients,
 Journal of Computational Physics **239**, 112-122, 2013.
 doi:10.1016/j.jcp.2013.01.008 369

IN MEMORY OF GIAMBERTO VIANO

BY

CARLO M. BECCHI

Dipartimento di Fisica - Università di Genova

Giamberto Viano, a retired professor of theoretical physics, passed away in Genoa on the 10 of November 2014, shortly after the death of his most intimate friend, Tullio Regge.

Although we did not see each other that often in the last years, during our mostly very casual meetings in the neighbourhood of Trento Street we dove into the sea of memories, friendship and considerations extending from physics to the chief world systems.

Giamberto was born in 1933, and having taken his degree in Turin, he and three other students preparing for a degree: Bertero, Bianchi and Canuto, working on a rather tough thesis on quantum three-body systems, moved to Genoa following Professor Augusto Gamba, joined by the Japanese young researcher S. Iwao. After graduation he had a research experience in the United States, in Rochester, where he met Gamba and Regge, and where his friendship with Tullio began. Between 1960 and 1961 a dynamic think tank composed of young graduates, named by the then frequent visitor Regge “*Torino Mare*”, was born.

Giamberto’s work was not confined to *Torino Mare*: he brought the ideas of Regge on scattering, i.e., the famous “*Regge poles*”, to the existing theoretical group already working in Genoa. Regge poles became in those years one of the most important matters in particle physics thanks to Chew and his entourage. What Giamberto contributed was not a mere international fashion trend but a rigorous method of mathematical analysis of scattering processes, a method suitable for studying interactions in different fields, including, in addition to particles, nuclei, light scattering and other numerous processes.

The most important feature of Giamberto’s work in that time was a missionary character, one could say, that motivated him to open the group to a larger number of collaborators, among whom, let me remind you, Bertero, Carrassi and Passatore who were working on phenomenological analysis. Later on, with Mario Bertero again and the analyst Giorgio Talenti, they looked into more elaborate mathematical aspects.

Away from the research collaboration, Giamberto was one of the most proactive “members” of a group of friends in the Physics Institute existing regardless of tensions in the highest ranks, dubbed by the keeper Silvi as the “Directors”. This group of friends changed the atmosphere, often turbulent in high ranks, into a cosy environment open to those beneath. That was how long years of student protests and contestations passed, without damaging the Institute’s life.

Meanwhile, Giamberto and Mario Bertero went on with their research of basic theory of scattering in collaboration with Giorgio Talenti. The study of inverse problem of the theory of scattering was followed by more general inverse problems and then by deconvolution problems and ill-posed problems. These questions were pursued in collaboration with a Belgian researcher, Christine De Mol and later turned to interesting applications in image reconstruction and finally in astronomy. Giamberto continued to develop deconvolution problems

analysis with particular regard to scattering by opening to new young graduates in Genoa: Di Salvo, Cuniberti, Magnoli, Scalas, Fioravanti, and De Micheli. The latter had since worked with Giamberto until his very last day. Giamberto's international collaborators must not be forgotten, especially Jacques Bros from Saclay and Jacques Faraut from Paris, who were very intimate friends of him.

This brief story highlights what always motivated Giamberto's work: a missionary spirit, as previously defined, based on the idea that scientific research is a basic means to teach the young people. But to do this, research shall be based on strict discipline and not on a quest for success. Giamberto always knew that it took luck to achieve success.

MEMORY

BY

ENRICO DE MICHELI

Consiglio Nazionale delle Ricerche

Fifteen years of strict and intense scientific collaboration, born at the end the nineties, and continued with no interruptions, till the last days of Giamberto's life. Fifteen years that actually have been much more than a fruitful collaboration. They have been the last part of a story which begun much earlier, at the beginning of the seventies, when I was a teenager studying at the high school and Giamberto already was the Professor Viano. It happened in fact that we were neighbors, door by door neighbors. This almost certainly influenced my later choice to study Physics at the University. Perhaps had also a role in my later decisions the first time we met on that bus number 17, which was bringing me at school and Giamberto at the Institute of Physics, same path for some kilometers. At that time I was merely able to solve algebraic equations of the second degree and, for just a matter of courtesy, I asked him what was studying in those days. He, with an attitude halfway between seriousness and fun, said me something like: "Certain operators acting in functional spaces to describe the action of something ...". Of course that sentence sounded weird and had no meaning to me whatsoever. But what I realized on that bus was that behind the words "Physics" and "Mathematics" there was a world much larger than the one I was experiencing in the high school. Probably without being aware of what he did, Giamberto triggered in me the *curiosity*, that is, the indispensable fuel for doing research. I must however confess I would never have imagined that one day, some forty years later, I might find myself intent on collecting the memories of uncountable many days we spent together discussing about *Mathematics* and *Physics*.

Our scientific collaboration actually started several years later my graduation in Physics. For years I had been working on *Computer Vision* and, until the end of the nineties, I seldom met Giamberto and, even more rarely, we had scientific discussions. He was my Professor of "*Mathematical Methods for Physics*" during the course of study, where, by the way, we had also our first fight since I was bitterly disappointed for the final grade of the exam! But, substantially, at that time we had very few interactions. The opportunity to work together has been a math-physics problem he was tackling. It was on the statistical regularization of ill-posed inverse problems, in particular, in optics. He knew I was working on *Computer Vision*, a rather complex inverse ill-posed problem, and he proposed me to help him on his problem. I accepted and that's it. That was our first joint paper that, one year later, appeared on the SIAM Journal of Mathematical Analysis.

After that paper our collaboration continued non stop for the next fifteen years and interested many of the subjects Giamberto was working on earlier and some new topics I brought to him, primarily on *Signal Processing* and *Numerical Analysis*. The result of this work has been a long list of papers, which are indeed the articles appearing in the last part of all the volumes composing this collection. Papers on many different arguments, including

among the others: nuclear physics, particle physics, optics, computational physics, inverse problems, geometrical analysis and so on. A wide range of interests originated from what we rapidly realized to be a common feature (or defect, depending on the viewpoint) of our character, of our personal nature, i.e., we got quite rapidly bored of the current problem we were facing. Switching from *Math* to *Physics* and vice-versa has been often an effective operational way to keep high our interests and our passion in doing research.

In these years of joint work I learnt a lot of mathematics and physics from Giamberto, but what I wish to recall here is primarily his rigor, precision, I'd say punctiliousness in the work. Not only the obvious rigor required by mathematics, but the rigor in the study of the physical phenomenon, in collecting and interpreting the available data, in disassembling and analyzing *maniacally* each step of the reasoning which was supposed to lead us to the final result. Jumping over difficulties, forgetting (even small) logical inconsistencies or, as we were used to say, *hiding the dust under the carpet* was impossible with him, simply not allowed. This has been with no doubt the most important teaching I had from Giamberto.

I have organized Giamberto's papers in five volumes, barely reflecting the main arguments of his activity and interests. The first four volumes are logically connected by what can be considered the central theme which governed for so long his research, that is, the study and the applications to physics of the analyticity properties of certain mathematical entities. An interest, or better, a love for this topic connecting so strongly *Mathematics* and *Physics* that he certainly inherited from his friend Tullio Regge and that Giamberto has been able to transmit to me. Among these four volumes I chose as first the one on the *Nuclear Reactions Theory* only because it contains his first published paper.

The fifth volume, dedicated to the *Ill-posed problems and Regularization Theory* is the last one because it contains the last paper of Giamberto. Curiously (as it is used to do), the faith wanted that our first and last papers were on the same topic, *the probabilistic regularization of ill-posed problems*, somehow opening and closing a long lasting cycle made of joint work but also of friendship, and committing to me the sad task of putting the *cross* beside his name in our last article.

LIST OF VOLUMES

VOL. 1: NUCLEAR REACTIONS THEORY

VOL. 2: QUANTUM MECHANICS

VOL. 3: HOLOMORPHIC EXTENSIONS

VOL. 4: COMPLEX ANGULAR MOMENTUM IN QUANTUM FIELD THEORY

VOL. 5: ILL-POSED PROBLEMS AND REGULARIZATION THEORY

LIST OF CONTRIBUTORS

- Emilio Albino (*Consiglio Nazionale delle Ricerche, Genova*)
- Mario Bertero (*Università di Genova*)
- L. Bianchi (*Università di Genova*)
- Jaques Bros (*Centre d'Etudes Nucléaires de Saclay, France*)
- Mario Carrassi (*Università di Genova*)
- Gianarelio Cuniberti (*Technische Universität Dresden, Germany*)
- Enrico De Micheli (*Consiglio Nazionale delle Ricerche, Genova*)
- Christine De Mol (*Université Libre de Bruxelles, Belgium*)
- Elvio Di Salvo (*Università di Genova*)
- Jaques Faraut (*Université Pierre et Marie Curie, Jussieu, France*)
- Roberto Fioravanti (*Consiglio Nazionale delle Ricerche, Genova*)
- V. Gallina (*Università di Torino*)
- Syurei Iwao (*Syracuse University, NY, US*)
- Nicodemo Magnoli (*Università di Genova*)
- C. Keith Miller (*University of California, Berkeley, CA, US*)
- Giacomo Monti Bragadin (*Università di Genova*)
- P. Nata (*Università di Torino*)
- F. Pasqualetti (*Consiglio Nazionale delle Ricerche, Firenze*)
- Giulio Passatore (*Università di Genova*)
- L. Rebolia (*Università di Genova*)
- Tullio Regge (*Politecnico di Torino*)
- L. Ronchi (*Consiglio Nazionale delle Ricerche, Firenze*)
- E. Santandrea (*ENEA, Roma*)
- Enrico Scalas (*Università di Genova*)
- Irene Scorza (*Università di Genova*)
- Giorgio Talenti (*Università di Firenze*)
- Giuliano Toraldo di Francia (*Università di Firenze*)
- F. Toselli (*INFN, Torino*)