Ricci Tensors and Wine in Lugo di Romagna and Padova, Italy

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Some years ago the authors, who are both mathematicians and wine sommeliers, were invited by a local wine producer to organize a wine tasting course on the relationship between famous mathematicians who taught at the ancient and prestigious University of Padova (founded in 1222) in the past and the wines they may have during their lifetimes. After a short brainstorming session we gave birth to the course *"Drops of mathematics"*. Drops are interesting mathematical objects whose physics have long attracted the attention of differential geometers, mathematical physicists, analysts, and in the present day computational era, numerical analysts for simulating their behaviour in fluids. From a wine taster's point of view, wine is to be evaluated and not simply drunk, and that is why drops represented a fairly good definition of the measure to be taken during a tasting session.

Undoubtedly, Galileo Galilei is the best known mathematician who taught in Padova, but he was too obvious a choice. We instead wanted to talk about someone *less* known to the general public and especially to the attendants of our wine course, but nevertheless *well*-known to the mathematical community. Gregorio Ricci Curbastro was the person that we decided to begin with.[1] We started with him, mainly for a non-mathematical reason: as sommeliers we knew about and had already tasted, the very famous silky *Franciacorta DOCG Satèn brut* Ricci Curbastro (see Figure 1) produced by the homonymous farm estate founded by Gualberto Ricci Curbastro, a nephew of Gregorio. The Ricci Curbastro family had invested and been involved in agriculture since the thirteenth century, operating farm estates in

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[1]We also presented the works and wines of Tullio Levi-Civita and Francesco Severi.

Lugo di Romagna (Ravenna), in Rontana di Brisighella (Ravenna), and the farm estate of Capriolo in Franciacorta (Brescia), where the Satèn brut is produced. The acronym DOCG, which in Italian stands for *Denominazione di Origine Controllata e Garantita*, represents the highest quality level in which Italian wines are classified. The classification from the lowest to the highest quality is: *Vino da Tavola, VdT*, *Indicazione Geografica Tipica, IGT*, *Denominazione di Origine, DOC* and finally DOCG.

Figure 1: Ricci Curbastro Satèn brut was awarded for six consecutive years from 2001 to 2006 the "Cinque Grappoli" award by the Italian Sommelier Association (AIS) and successively by other wine societies worldwide. The Satèn Brut is the ultimate expression of the typicality and harmony of Franciacorta DOCG.

Gregorio Ricci Curbastro was born in Lugo di Romagna, or simply Lugo, on January 12, 1853 (see Figure 2). The name of the town refers to the part of the region, Emilia Romagna, to which it belongs. This part of the region was under the administration of the Vatican state for about 1000 years. Today the area is famous for its rich cuisine, its wonderful beaches, and vibrant nightlife. Surely at the time of Gregorio Ricci Curbastro the life style was much different!

The house in Lugo in which Gregorio grew up is still standing (the ad-

Figure 2: This map shows the cities of our story and some other important and well-known towns: Roma, Milano, Torino and Firenze.

dress is Corso Garibaldi 41 - 48022 Lugo). At the age of 16 he moved to the universities of Bologna, the Scuola Normale Superiore of Pisa and Padova where he received the "laurea" degree in mathematical sciences in 1875. The municipality of Lugo is also proud of this famous citizen for two other reasons. Firstly, as a member of the municipal council of Lugo he presented, among other things, a deep and detailed study on controlling the water level in the local canals to prevent flooding in the area. Secondly, due to his research, he provided mathematical tools to Albert Einstein for the development of the theory of general relativity. In Lugo on the facade of the Ricci Curbastro family home there is the inscription (see Figure 3): **"Diede alla scienza il calcolo differenziale assoluto, strumento indispensabile per la teoria della relatività generale, visione nuova dell'universo"**, that can be translated as *"He gave to science the absolute differential calculus, the fundamental tool for the theory of general relativity, a new view of the universe"*. There is also the Ricci Curbastro family tomb in the Lugo cemetery, in Via de' Brozzi 68 (Lugo), where Gregorio was buried (see Figure 4) and a lyceum dedicated to Gregorio Ricci Curbastro and in San Vitale, a part of Lugo, a street is named after him. Lugo di Romagna is also connected to another famous Italian, the opera composer *Gioacchino Rossini*. For our readers we suggest to visit and perhaps attend an opera, in the *Teatro Rossini* one of the most interesting theatres

Figure 3: House where Gregorio Ricci Curbastro was born. The first author went to visit the house (he is standing below the inscription), but nowadays it belongs to new owners and is not open to the public.

"all'italiana" of the Emilia-Romagna region (see [7]). It is also worthwhile visiting *Casa Rossini*, the house that was owned by Rossini's father, now converted into a museum.

Returning to Gregorio Ricci Curbastro and his connection with the town of Padova, he was full professor of mathematical physics at the famous and old University for 45 years, from 1880 till his death in 1925. It seems he was proud of this: on the headstone of his grave is written (in Italian) "per 45 anni professore nell'Università di Padova" (see Figure 4). In [[5]] we read on the front page: *"Ricci Curbastro was the Italian mathematician who saved the general relativity of Einstein"*. It is well-known that Einstein was stuck and found in the *Ricci tensor calculus* the algorithmic tool for transforming his intuition into a solid physical theory. Unlike Einstein, Ricci Curbastro was a distinguished and austere nineteenth century gentleman who was very humble, reserved, and devoid of communicative warmth (see his portrait in the left part of Figure 5). But Einstein recognized in Ricci the mathematical genius who produced that elegant theory and (see [3]) went to Padova on 27 October 1921 just to meet him. Einstein gave a talk in the same room,

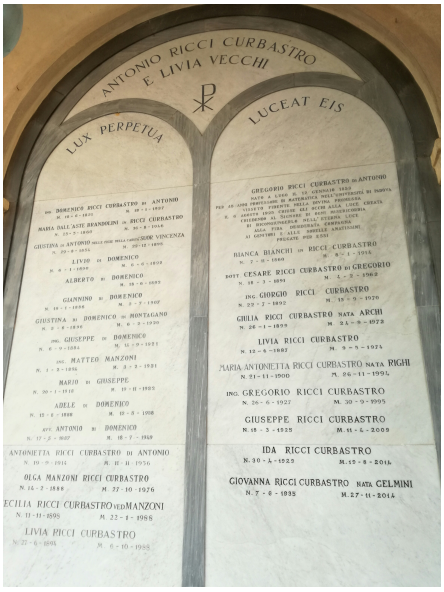

Figure 4: Ricci Curbastro family tomb in the cemetery of Lugo where Gregorio, his wife and relatives were buried.

the "Aula Magna" at *Palazzo del Bo* (in English Bo means Ox), at Via 8 Febbraio 1848, where three centuries earlier Galileo had given his lectures on the new theory of mechanics. As a side note, the Palazzo del Bo is today the location of the Rector's offices. Unfortunately, there are no photos of that occasion, but it was well documented in the Italian newspapers and in a short article appeared in the local newspaper *Il Veneto*, as reported in [5, p. 254].

There are other places in Padova where we can find traces of Ricci Curbastro. The first and most important is the Department of Mathematics, in Via Trieste 63, recently dedicated to Ricci Curbastro' most famous student, Tullio Levi-Civita. On entering the Departmental Library (entrance from stair A, floor -1), we immediately see the bas-relief in Figure 5. Moreover, by asking the librararian one may take a look at his papers. On the fourth floor his old desk is currently being used by our colleague of mathematical logic, Professor Giovanni Sambin, a member of the *Accademia Galileiana di Scienze Lettere ed Arti in Padova* of which Ricci Curbastro was president from 1920 to 1922 (see [1]). In Figure 6 Professor Sambin is seated at Ricci Curbastro's desk. In 2005, on the occasion of the World Physics year, the University of Padova dedicated a medal to these two famous mathematicians

Figure 5: Left: Ricci Curbastro portrait. Right: the bas-relief in the Department of Mathematics library, it says "The austere image of Gregorio Ricci Curbastro among the books that he connected to the study, where he was a venerated teacher [...]"

(see Figure 7) that can be found in the archive of the University, located in the *Palazzo del Bo*. On the front side there are the two "columns of modern physics": Einstein and Galileo. Galileo, as we already noted, was professor in Padova for 18 years, from 1592 to 1610, the year he published his famous book "Sidereo Nuncius". In it he wrote "I spent 18 years in Padova, the best of my career". Einstein as we already observed, was grateful to Ricci Curbastro and Levi-Civita for the mathematical tools they provided with the *absolute differential calculus*. On the back side of the medal there are the two mathematicians that made the University of Padova a center of attraction for the mathematical physics and geometry of the beginning of the twentieth century. For interested tourists, in the Palazzo del Bo, in addition to Galileo's podium, one can see the world's first permanent anatomical theatre, dating from the 16th century. These and other important "symbols" of the University can be visited by taking one of the daily guided tours organized by the University (they can be booked online at the University web site `www.unipd.it`).

Figure 6: The desk, now used by prof. Giovanni Sambin, was owned by Gregorio Ricci Curbastro

Figure 7: This medal is kept at the University of Padova's main archive at the main building of the University: *Palazzo del Bo*. It was designed by the sculptress Orietta Rossi on the occasion of the *World Physics Year 2005* (see the brochure [2] at p. 29.).

In Padova there is still more evidence of Ricci-Curbastro's role in the history of the town. The municipality of Padova has named a street after this prominent citizen, Via Gregorio Ricci Curbastro (GPS coordinates $[45.396772, 11.890183]$). This street intersects another named for Levi-Civita.

There is also a primary school dedicated to Gregorio Ricci Curbastro and the house where he lived during his time in Padova. The house was located near the Abbey of Santa Giustina, the oldest and biggest church of Padova (paleo-christian architecture dating back to the year 565). Unfortunately, this house does not belong this his family anymore and there are no more indications to find the house.

Padova has a number of other other architectural pearls. Among them we recommend visiting the Cappella degli Scrovegni completely decorated by Giotto's frescos, the Palazzo della Ragione which was the old tribunal (built in 1218) consisting of a single hall of size 81 by 27 meters and height of 27 meters. We also suggest a visit to the Basilica of St. Antony simply known as "Il Santo". More information can be found at the link [8].

The reason people do not know much about Gregorio can be found in many testimonials (cf. [4, 5, 3]) which commonly describe him as a *gentleman, not interested in the social life, in perfect harmony between science and faith, the man that for nearly half a century ran the frontiers of knowledge* (see the commemoration paper [4] in the occasion of the centenary of his birth). Mr. Marchiani Mauro, president of the association "Pro Loco di Lugo" (see also [6]), confirmed this, telling us his reserve, common to many mathematicians, made him not as popular as other citizens of Lugo, like Francesco Baracca, one of the most famous Italian war heroes. But this is another story.

Gregorio Ricci Curbastro split his life mainly in two regions: Emilia Romagna and Veneto (see Figure 2). We like to think that he was used to eat typical dishes and specialities of the regions accompanied by classical local wines. In Lugo he perhaps enjoyed the "Tardura", is a lumpy egg-soup, accompanied by the typical red wine "Sangiovese". In Padova he could have tasted the "Gran bollito alla padovana", which consists of different pieces of boiled meats (beef, chicken, pork) accompanied with the traditional "Friularo", one of the most popular red wines of Padova area.

We would like to conclude our tour as we started, with the Satèn sparkling wine, by making a toast to this great mathematician. Indeed, just before last Christmas, following a long tradition at the Department of Mathematics, we organized a departmental party (in which everyone brings something and shares it with their colleagues). On this occasion we used the Ricci Curbastro Satèn (see Figure 1) to make our toast of season's greetings to everyone by honoring the memory of our past colleague: the great *Gregorio Ricci Curbastro*. Readers can order this wine from the on-line store `http://www.riccicurbastro.it/inglese/`.

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