

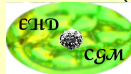
# Beyond the horizon. Memories of Antonio Castellanos Mata.

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I am grateful to all of you who have come to remember and honor Antonio. Many of you knew him. Antonio was a true scientist and an exceptional person. It is impossible to realize and accept that he is not with us any longer. I will review some facts from his biography, personal recollections, and will only slightly address some scientific matters. Many thanks to Cele Abad Zapatero for his valuable comments and for correcting my English.

Minisymposium dedicated to Antonio in the frame of “Advanced Problems in Mechanics” 2017 conference, St. Petersburg, 25th of June - 1st of July. Those who are interested in the event please send me an email ([elgreco@pdm.ras.ru](mailto:elgreco@pdm.ras.ru))

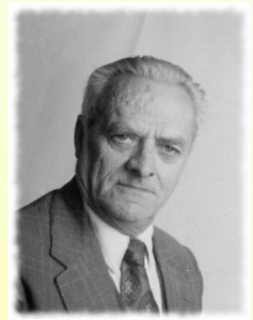
<http://apm-conf.spb.ru>

<http://www.pdm.ras.ru/~elgreco/Antonio/ms/ms-Antonio-Castellanos.html>

## Antonio's family

Antonio was born in Antoñanes del Páramo, a village near León, on 7th of March of 1947. He was the third (and last) child in the family.

His father, Manuel Castellanos Berjón, was a talented teacher with a rebellious character and an acute mind. He taught children during all his life, though for many years he was prohibited legally to do it (he was a “republican teacher”, persecuted by the franquist regime, and was in the list of republicans condemned to death).



## Antonio's family

Antonio's mother, Fidela Mata Sarmiento, was a woman of exceptional intelligence, fortitude and strong, emotional personality. The intense but tormented relation of Antonio's parents resulted in their separation in his early childhood. However, his father continued to be in touch with the children. He taught Antonio mathematics. Antonio's mother always admired science and loved to read.



## Antonio's family

Close family ties with his mother and his siblings, Domingo José and Aurora, were very important for Antonio during all his life.

Antonio with his mother and siblings. Gijón, 1997



## Beyond the horizon

Antonio always had a passionate character, curiosity and courage. As a child, perhaps of seven years old, once he escaped from home. At the end of the day they found him very far in the field. Antonio was walking for several hours, being firmly decided to go beyond the horizon. In a way, he was trying to do this during all his life.



## Childhood

When Antonio was six years old, the family moved to León. Antonio used to go to León's cathedral. Looking at its stained glass windows, at its pure beauty, he experienced a mystical feeling. He asked God to take him to Heaven before he committed a sin. Fortunately, the Lord did not pay attention to this petition. Being very religious, Antonio decided to become a priest and entered the seminary.



# Childhood

However, in his adolescence he started to have philosophical doubts. He could not accept that there was pain and injustice in the world. He questioned the religious philosophy they were allowed to study. Antonio rebelled against the Lord and also he was not happy with the atmosphere in the seminary. However, he stayed there despite hard conditions because the family was short of money and he did not want his mother to pay for his education. Antonio was studying mathematics and physics on his own. Finally they discovered his diary with all his observations, personal ruminations and philosophical reasonings, and expelled him from the seminary a few months before the graduation. Nevertheless, Antonio prepared himself for the exams and entered the University of Valladolid.



# University of Valladolid

Antonio said that he decided to become a physicist because once when he was an adolescent, in the summer they put him to harvest wheat. It was hard work, so Antonio thought: “That’s not for me. I better study” ...

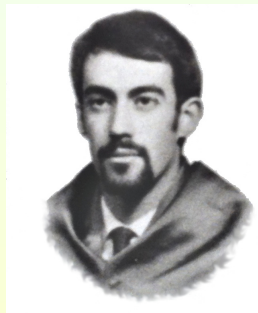
During the years in the University of Valladolid he made friendships that lasted until the very end of his life, even if for long periods he was not in touch with his friends. Rosa María Marcos Flores, Celerino Abad Zapatero, Luís Bailon Vega, Miguel Moreno Mas, they also supported him during the last, difficult period of his life. He spent many hours together with Carlos Criado Cambón and they shared precious memories from those encounters. All the friends were maturing together talking about life, books, science, feelings, politics, drinking wine together, playing chess... They were young and free, and everything was still ahead: unplanned, unexplored.



Rosa



Antonio



Cele

Cele Abad Zapatero. Tribute to a Friend: Antonio Castellanos Mata  
<http://crystaledges.org/tribute-to-a-friend/>

## Revolutionary mind. Young anarchist

Antonio had a strong love for freedom and a rebellious mind and heart that could not tolerate injustice.

Those years were the last years of Franco's regime. Antonio participated in the anti-franquist movement, which, of course, was strongly prohibited. He was a member of Workers' Revolutionary Organization (Organización Revolucionaria de los Trabajadores), a radical leftist group. Once he was hiding the secretary of the party at his home. If they would have been discovered by the authorities, both would have been incarcerated for years.

Later, Antonio left the party for two reasons. First, he did not like the idea of discipline; Freedom was something that I think he cherished most. Second, during the elections there were less people voting for the party than the number of its members, and workers were not interested in their ideas.

## Trip to Latin America



Antonio obtained the Fulbright scholarship and spent a year in Ohio University (08-72/09-73). He finished his stay with a trip through almost all of Latin America with his friend Sergio. He visited most dangerous places, since he wanted to know how people lived. He used to walk with a big machete hidden under his long poncho. He had a big beard at the time and looked suspicious. When they entered the pubs where miners were drinking, Antonio was not sure who felt more worried, but finally they drank wine and toasted together.

During his trip Antonio made friends in various countries. His Colombian friend Elsa gave him a present, a carved wooden figure of Don Quixote. For me this figure is a symbol of Antonio.

## First marriage

During his stay in USA Antonio met his future first wife, María Elena Navarrete Sandoval, born in Aguascalientes, Mexico. They married in 1975 and had two children: Antonio and Dayeli Anahí. Antonio Castellanos the son inherited from his father a profound interest in science and its social value (sociological aspects of agriculture).



Two Antonios  
(Seville, 2015).

Dayeli  
(Holland, 2004).



## Starting to work. EHD

In 1972 Antonio defended his PhD thesis on nuclear physics at the University of Valladolid. He was the first PhD in Physics in the University. Having come back from the USA, he started to work at the University of Valladolid, and later at the University of el País Vasco. In 1978 he entered the group of Professor Manuel García Velarde in the Universidad Autónoma de Madrid.

During this period he met Pierre Atten, who inspired in him the love for electrohydrodynamics and, as Antonio said, “taught him to think”. They had a long-lasting collaboration. Pierre also became his close friend.



Antonio and Pierre. Varna, 2005

# University of Seville

In 1983 he obtained the position of full professor in the University of Seville. He worked there 33 years, until the end of his life.

Antonio founded a scientific school of international reputation. He was the head of the research group of “Electrohydrodynamics and cohesive granular media”. He cared for his students scientifically and tried to help them. They felt affection for him and supported him very much in the most difficult times.



Seville, 2004

# University of Seville

Antonio directed an enormous number of projects, something that allowed him to found two excellent experimental laboratories in the University. During 12 years he was the head of the department. He liked very much to teach and gave classes in the university during all his life.

He is an author of hundreds of scientific articles, cited several thousands times. Despite of this, he never signed an article where he did not contribute, and hated the indices of scientific impact. He said that one should compare one's important works with those of great scientists.





## Fine Powders

Antonio continued to travel and to collaborate with scientists in different countries (USA, France, UK, Nicaragua, Russia). Meeting with Keith Watson resulted in more than 15 years of collaboration with the Xerox Corporation and discoveries in the science of granular materials.

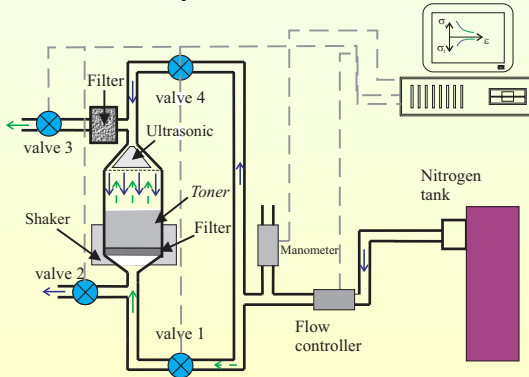


Keith Watson and Antonio

- Why do little round particles flow badly?
- Which interactive forces are important for toner particles?
- How do they influence bulk properties?
- How to measure any bulk properties in a reproducible way?

# Sevilla Powder Tester

Initialization by means of fluidization



Estimation of tensile yield stress:

$$\sigma_t \approx \Delta p_{max} - weight$$

Modification of SPT to measure acoustic properties: rectangular cell with transducers, Helmholtz coils (for magnetic powders)

Antonio worked in many domains of physics; he was interested in everything and was keen to learn new things. When I came for the first time to the University of Seville and saw the nameplate on his door “Antonio Castellanos Mata, Full Professor of Electromagnetism”, he said to me: “There is an error here”. I was much surprised. “It should be written: Antonio Castellanos Mata, **student** of Electromagnetism”, - he explained to me.

Antonio not only never tried to seem “a very important person” and treated his students as colleagues, with friendly respect. He indeed permanently made efforts to advance, to learn something new. At a certain moment he needed a model for interaction of toner grains. He studied from ‘basic principles’ contact mechanics, estimated the forces acting between grains and based on that reasoning suggested — together with his colleagues — a new elastoplastic model with adhesion, which not only arose the interest of the leaders in mechanics (K.L. Johnson, I.G. Goryacheva, and P.A. Zhilin) but, more importantly, yielded good predictions for the experimental results.

# Some of Antonio's Scientific Contributions

- Galilean limits of electromagnetism.
- Temperature equation and entropy production in EHD.
- Seminal works on numerical simulation of EHD flows.
- Physical mechanism of electrothermohydrodynamic instabilities.
- Energy cascade in EHD turbulence.
- Stabilization of dielectric liquid bridges by ac electric fields.
- Absence of inertial (collisional) regimes in fine powders for negligible interstitial gas interaction.
- Sevilla Powder Tester: apparatus to characterize fine powders.
- Triana Powder Tester: apparatus to characterize the cohesive properties of grains.
- Model of elastoplastic contact between two powder particles.
- Microstructure characterization of fluidized bed of fine particles: aggregation, solidlike-fluidlike transition, fluctuations, influence of electromagnetic fields.
- Experimental setup for measuring acoustic properties of fine (including magnetic) powders.

When I met Antonio for the first time, in June of 1997, at the Microgravity conference in St. Petersburg, I was impressed by a combination of his intelligence, maturity, and a childlike smile, curiosity and capacity to enjoy the beauty of the world.



Antonio looked at the tender pale sky of white nights, at the lake Ladoga, and said with a completely happy look: “Fantastic!”

*Thus I draw from the absurd three consequences, which are my revolt, my freedom, and my passion. (A. Camus)*

When we are little, we see each flower, an autumn leaf, a snowflake as something beautiful and marvellous, different from other flowers and leaves. A child, without knowing this, is an absurd man of Camus, he still does not need to put the incredible variety of the world in terms of standard concepts and names. For this, he lives intensely. So Antonio did until the very end, in his happy days and even during his illness. When he watched a sunset, each time it was a unique sunset, with its tender fire of colors. A bush with yellow flowers under the wind on a road, touched his heart and made him happy. Antonio never cried, but I saw him deeply affected looking at a cloud covering the sun. In this way, as Camus' absurd man, Antonio lived many lives. He loved poetry and music, science and nature, and people. "To create is to live twice". Antonio was a profound and creative scientist and wrote a few but beautiful poems. He also was a traveler, another absurd protagonist.

## *Il n'y a pas de honte à préférer le bonheur*

I was fortunate and honored to become Antonio's wife. We have two children, Leon and Ivan, who now are nine and four years old. They continue to love and think of his father as if he would be alive, as I do. They inherited his curiosity and deep wish and desire to understand Nature. I think everyone who knew Antonio, experienced that just being near him made you feel free and well at the most basic level. Antonio knew to give internal freedom to people, let them become themselves. He liked to feel happy ("There is no shame in preferring happiness", as Camus said), he was joyful, gentle, careful and had a very nice sense of humour.



## APM Conference anecdotes

Antonio used to attend the “Advanced Problems in Mechanics” conference organized each year in St. Petersburg. As everywhere, Antonio had there a big success as a scientist and as a person. In particular, my colleagues, especially the young people, considered impossible to have drinks without Antonio.

Once Antonio entered the session a little late. “You see,” - he told me showing his case, - “this is a very good, practical bag, they gave me it at the IEEE conference, it is not big but everything fits there very

well”, and started to open it. I thought he brought me some articles we had talked about. “But I had to enter the session slowly to avoid it sound” - and he showed me several bottles of beer, just bought, that indeed fitted perfectly in the bag.





## Conference anecdotes ctd

Another time at the APM, at night, we were drinking wine together with our friends in the room of the conference hotel. We were having a great time but our neighbors probably not (or were trying to sleep), since they knocked on the wall. We started to speak softly. Only Antonio who learnt some useful phrases in Russian, told me in a normal voice, “Shouldn’t we ask: KTO TAM? (Who is there?)”

At another conference they gave us tickets for lunch and banquet together with the badge, on its other side. Often these badges turned over. Once Antonio had an interesting scientific discussion with a participant and after a while, looking at his badge, said: “I have met at this conference many namesakes. There are a lot of people here called Lunch Ticket”.

## The knight without fear and beyond reproach

I am not sure if Antonio ever experienced fear. I already mentioned his trip to Latin America in his youth. Being in Chile just before the 1973 Chilean coup d'état, he was alerted and advised by his local friends that it was dangerous to stay. They went away via mountain passages for a couple of days before the coup and avoided the destiny of many Chilean and Spanish leftists. Much later Antonio and Ricardo Marqués went to collaborate with Nicaraguan scientists during the civil war between sandinistas and contras. They also travelled, in particular, they went to the city of Bluefields by Escondido River. The authorities alerted them that they must go 'on their own risk'. When going there by boat "Bluefields express", they had to lie upon the floor several times hiding themselves from shots. Antonio was 43 years old at that time. Antonio assured me that he took all necessary precautions in this trip. "I always took rum or beer", he said, "Ricardo was rather careless, he drank water, so he got hepatitis and I was perfectly well".

# The knight without fear and beyond reproach

It is much more difficult to resist a deadly dangerous disease than to withstand during some hours when they try to shoot you. One day Antonio, who always looked and acted as a young person and had an excellent health, had to face and fight against kidney cancer of a very rare and aggressive type. However, I never saw Antonio in panic. He was affected but did not show fear, being more worried for us than for himself. He fought with fortitude. We did everything possible and impossible. He had strong pains but fortunately he overcame them. Then he started, despite being weak, to swim, to dance, to travel a little. We went for a walk in mountains one month and half before his death. He did not want just to become “a patient”; he enjoyed the life when he could and continued to work until his very last days. The destiny gave him and all of us, a cruel and unfair blow. He passed away on the 27th of January of this year.

Antonio was one of those who have the courage to live their true life and to choose their own way. And, perhaps, there is nothing more long-lasting than traces in the sea left by these people.

Caminante, son tus huellas  
el camino y nada más;  
Caminante, no hay camino,  
se hace camino al andar.  
Al andar se hace el camino,  
y al volver la vista atrás  
se ve la senda que nunca  
se ha de volver a pisar.  
Caminante no hay camino  
sino estelas en la mar.

*Antonio Machado*

Wayfarer, the only way  
is your footprints, there is no other.  
Wayfarer, there is no way,  
you make the way as you go.  
As you go, you make the way  
and stopping to look behind,  
you see the path that your feet  
will never travel again.  
Wayfarer, there is no way;  
Only foam trails in the sea.

*Translated by Alan S. Trueblood.  
A. Machado Selected Poems, 1982*