Dante Gatteschi CV

Education

- Laurea cum laude, University of Florence,1969

Academic career

- Assistant Professor, University of Florence, 1969 -1980
- Lecturer, University of Florence, 1976 -1980
- Professor of Chemistry, University of Florence, 1980 – 2015

Awards

The scientific activity of Dante Gatteschi is pivoted in the fields of solid-state chemistry and physics and it reaches levels of excellence as shown by the Gatteschi's h-index and by the number of citations received by his papers. He is the third more cited chemist in Italy after Balzani and Prato and among the top 250 world chemists. His excellence was recognized also by several awards he received:

- Nasini Award of the Italian Chemical Society, 1979
- Magnetic Resonance Award of the Italian Chemical Society, 1993
- Van Arkel Honorary Chair, Leiden University, 1999
- Bruker Prize for EPR Spectroscopy, 2000
- Muetterties Memorial Lecture Berkeley, 2000
- Blaise Pascal Chair, Ecole Normal Superieure, Paris, 2001
- Agilent Technologies Europhysics Prize, 2002
- Laurea h.c. in Material Science, University of Cagliari, Italy, 2005
- John Francis Vigani Lecture, awarded by Royal Society of Chemistry - Dalton Division, Material Chemistry Forum and Società Chimica Italiana, University of Cambridge, Great Britain, 2006
- Franco - Italian Prize of the Société Francaise de Chimie and of the Società Chimica Italiana, 2007
- Doctorate h.c. University of Bucharest, Romania, 2011
- Doctorate h.c. "Dr.rer.nat. h.c.", Senate of the University of Stuttgart, Germany, 2013
- Cannizzaro Medal, Società Chimica Italiana, 2014
- International Zavoisky Award, 2015
- Cannizzaro Award of the Italian Chemical Society, 2015
- *Emeritous professor* of the University of Firenze.
- Member of the Accademia Nazionale delle Scienze detta dei Quaranta
- Member of the Accademia Nazionale dei Lincei
- Member of Deutsche Akademie der Naturfoscher Leopoldina
- Member of the Akademia Europea

Activities

- Member of the Editorial Board of the New Journal of Chemistry, Gazzetta Chimica Italiana, Journal of Materials Chemistry, Advanced Materials, Comments in Inorganic Chemistry, Chemistry of Materials, Journal of Rare Earths, Angewandte Chemie.

Services

- Chairman, Chemistry Department, University of Florence 1985-1988
- Chairman, Interdivisional Group of Magnetic Resonances, Italian Chemical Society, 1989-1991
- President of the Corso di Laurea in *Controllo di qualità nel settore industriale farmaceutico*, of the Faculty of Pharmacy, University of Florence, 1995-1998
- President of the Corso di Laurea in *Scienze farmaceutiche applicate*, of the Faculty of Pharmacy, University of Florence, 2009-2011
- Chairman, Consortium of Italian Universities for the Chemistry of Materials, INCM, 1992-1997
- Chairman, Consortium of Italian Universities for the Science and Technology of Materials, INSTM, 1997- 2012
- Coordinator of Research Training Networks on molecular magnetic materials in several projects of the III, IV, V, and VI Framework Program of the EC
- Coordinator Marie Curie Training Site Centers "Molmag I" and "Molmag II", in the V and VI Framework Program of the EC
- Coordinator of the Network of Excellence "Magmanet"- Molecular Approach to Nanomagnets and Multifunctional Materials - of the VI Framework Program of the EC
- President of the *EIMM - European Institute of Molecular Magnetism S.c.a.r.l.*

Publications

- >530; *h-index* 92; total citations > 45,000; average number of citations per paper > 85 (WoS, August 2019)

Books

- R. D. Willett, D. Gatteschi, O. Kahn (Editors), "*Magneto-Structural Correlations in Exchange Coupled Systems*", NATO ASI C 140, Reidel, Dordrecht, 1985
- Bencini, D. Gatteschi "*EPR of Exchange Coupled Systems*", Springer Verlag, 1990
- D. Gatteschi, O. Kahn, J.S. Miller, F. Palacio (Editors), "*Magnetic Molecular Materials*", NATO ASI E 198, Plenum, 1991
- E. Coronado, P. Delhaès, D. Gatteschi, J.S. Miller (Editors), "*Molecular Magnetism: from Molecular Assemblies to the Devices*", NATO ASI E 321, Kluwer, 1996
- D. Gatteschi, R. Sessoli, J. Villain "*Molecular Nanomagnet*", Oxford University Press, 2006
- C. Benelli, D. Gatteschi, "*Introduction to Molecular Magnetism: From Transition Metals to Lanthanides*", Wiley-VCH, 2015

Research interests in brief

Magnetic Molecular Materials - Theoretical Inorganic Chemistry – Solid state inorganic chemistry - Electronic Structure of Metal Complexes - Interactions among Metal Ions - Organic Radicals - EPR Spectroscopy - Nonostructured Material

During his career he was always involved in frontier research themes that range from the initial study of the electronic properties of simple paramagnetic ions to the possible *application of nanostructured material, crossing the possibility to exploit the properties of isolated single molecule.*

Description of the main scientific interests

Dante Gatteschi graduated in Chemistry at the University of Florence in 1969, a time when in Italy there was no PhD program. Immediately after graduation he obtained a post of Assistente with Professor Luigi Sacconi, the founder of the School of Inorganic Chemistry in Florence. He spent all his academic career in the same University, where he has been Professor of General and Inorganic Chemistry in the Faculty of Pharmacy since 1980 but, after receiving the Europhyisics Prize during the year 2002, he has also been in charge of the course of Magnetic Molecules at Physic of the Faculty of SMFN.

His early scientific interests were focussed on the use of ligand field theory for the description of the electronic structure and of the spectral and magnetic properties of low symmetry transition metal compounds. Among the most interesting results the development of suitable models for the electronic levels of five coordinate transition metal compounds, a hot topic at that time, and a battle horse of the Florentine school of Inorganic Chemistry. In the late sixties there was a revolution in the treatment of the magnetic properties of transition metal ions because chemists started to routinely use quantum mechanics and Gatteschi started a systematic investigation of the properties of low-symmetry compounds. In fact, Sacconi had opened the field reporting five coordinated high spin complexes for which the spectral- theoretical treatment was not available. Gatteschi extended the treatment in a series of papers which showed how Ligand Field theory could be successfully used for low symmetry compounds. The highlights were the structural magnetic correlations in simple compounds, which gave a detailed understanding of the magnetic properties of mononuclear compounds.
The need to investigate copper(II) compounds undergoing Jahn-Teller distortion pushed him to use EPR spectroscopy as a strong tool for the understanding of the static and dynamic structures of transition metal ions. Many papers have been devoted to the correlation between spin Hamiltonian parameters of the EPR spectra and electronic structure of the metal ions. For instance a systematic investigation of the EPR spectra of high spin cobalt(II), a difficult ion for EPR because very low temperatures are needed to observe the spectra, provided for the first time a clear understanding which opened the way to the interpretation of the spectra in biological systems.

The natural extension of these investigations was towards systems in which metal ions are magnetically coupled, first in pairs, and later in more and more complex structures. Again, the use of EPR in this area has been very extensive, and some important results were summarized in the book co-authored with Alessandro Bencini on “EPR of Exchange Coupled Systems”, which is largely referenced by people active in the field. Particular attention was devoted to mixed valence pairs: the system with two nickel ions (Ni^{II}-Ni^{I}) bridged by naphthiridine ligands is still a classic example of strong delocalization.

The interest for the magnetic properties of transition metal compounds gave the idea that bulk magnets could be obtained using molecules rather than the classic inorganic systems based on metal or ionic lattices. At the beginning the buzz word was molecular ferromagnets and the Florence group he was leading tried several different approaches which however yielded one ferromagnet with a critical temperature of 0.5 K, certainly not exciting for applications. Other types of compounds were tested, and it was realized that new types of magnetic properties could be obtained. The field was called molecular magnetism and it is still one of the relevant topics of large current interest, both as the design and synthesis of molecular based magnetic materials and as the investigation of single-molecule magnets. In the former field the original approach was that of using metal ions directly bound to stable organic radicals, like nitronyl nitroxides and semiquinones. Molecular ferrimagnets with critical temperatures up to 25 K have been synthesized, and their magnetic properties investigated with a large number of different techniques, ranging from magnetization to neutron diffraction and scattering. In fact, it is one of the features of the Gatteschi's group that of using many different physical techniques and going deep in the physical characterization of the materials. This is particularly clear in the last investigations on the single molecule magnets, which were discovered in Florence, and which are currently in the forefront of intensive interdisciplinary research, aiming at the investigation of molecular bistability and of quantum tunnelling of the magnetization.

For sure the most important achievement of Gatteschi group was the discovery that a cluster containing 12 manganese ions bridged by oxo-groups has a ground S = 10 state with a high Ising type magnetic anisotropy. As a consequence of this structure the magnetic relaxation becomes extremely long at low temperature. In fact, if the magnetization is oriented parallel to the magnetic field when the field is removed the system goes back to equilibrium by climbing a ladder of levels in an exponential fashion. The relaxation time becomes extremely long at low temperature.

The individual molecule becomes a tiny magnet. In fact, the system was called single molecule magnet, SMM. The interest for the magnetic behaviour of these molecules was that of using them as basis for extremely high-density computer memories. There is another feature which we have not yet mentioned but is extremely interesting. In fact, the molecules have a quantum behaviour and the magnetization can relax via tunnel effect. The theory of this behaviour had been worked out but there had be no check because no system was available. SMM filled the gap between theory and experiment and this discovery was found to be of large interest for chemists, who tried to change the properties of the molecules to yield tailor made SMM. On the other hand, physicists were excited because new magnetic properties could be investigated. The Gatteschi group managed to find other examples of SMM and obtained an important success with a cluster of eight iron(III) with a high anisotropy of the ground S = 10 state. The result of systematic investigations gave a good understanding one-dimensional ferrimagnets show slow relaxation of the magnetization at low temperature as shown by SMM. The new magnets were called single chain magnets, SCM. The theory needed to treat SCM was worked out.

The systems described so far were based on transition metal ions, but early results were reported by Gatteschi on systems containing rare earth ions. It was found that gadolinium(III) gives ferromagnetic coupling with nitronyl nitroxides molecules. One dimensional compound with M= Gd gave a rather unpredictable antiferromagnetic behaviour which was justified by demonstrating the existence of a next nearest neighbour coupling. The detailed study of these compounds showed the chiral transition of the magnetization. Again the theory of the transition was worked out by Villain and was confirmed later when the Gd(III) derivative was obtained.