Galaxy Evolution: Theory and Observations (Cozumel, Quintana Roo, México, 8-12 April 2002)
Editors: Vladimir Avila-Reese, Claudio Firmani, Carlos S. Frenk & Christine Allen

CLAUDIO FIRMANI: A BREATH OF THE RENAISSANCE

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1. INTRODUCTION

More than twenty years ago, to be precise in 1981, in this hotel and in this very same conference room, Claudio Firmani was holding IAU Symposium 99 on the topic Wolf-Rayet Stars: Theories and Observations; his love for the Mexican Caribbean also lead him to organize, across the channel, in Playa del Carmen, the First Joint Mexico-US International Workshop on Neural Networks and Neurocontrol in 1995 and again, in 1997, in the same place, the Second Workshop on Neurocontrol.

I mention the above meetings to illustrate Claudio Firmani's wide interests and his motivation to understand the Universe in an integral and harmonious way.

2. THE BEGINNING

Of course, the beginning had to be in Italy, in Rome, on March 1941. As a child, in the early postwar years, Claudio already had a strong interest in technology. He was passionate about invention and inventors. Indeed, he was a great admirer of Marconi, whose grandson, Francesco Paresce, was to be years later his colleague at the University of Rome and his collaborator in the innovative detector: the Mepsicron. In his childhood, he was fortunate to have influence and motivation from his father, and from a neighbor in the military who was passionate about electronics; under his guidance, Claudio built a five-bulb receiver, as well as transmitters which interfered with the neighbor's receivers. A few years later, at the age of 13, our friend discovered Physics! A physics book got into his hands; the beauty of Physics captivated Claudio, and since that moment he decided that he wanted to be a physicist. From that moment, and throughout his life, the passion and the curiosity to discover the secrets of nature was also to be linked with his desire to transform it. When Claudio entered the University of Rome, at the School of Physics, he met very good professors and found a good equilibrium between theory and practice at the laboratories; he was captivated by the theoretical and formal aspects of science; in particular, his contact with the general theory of relativity seduced him completely, and from relativity to astronomy the transition was easy. Livio Gratton was the director of the Laboratory of Astrophysics in Frascati and was the inspiration for a group of young students that got their first experiences in research at Frascati, among them: Castellani, Renzini, Caloi, Macchetto, Panagia, Orcchionero..., now well known names in Astronomy who, together with Claudio, made the atmosphere at Frascati a very stimulating one.

3. GO WEST (AND SOUTH) YOUNG MAN

After his doctorate, Claudio Firmani began to wonder where to go; his horizons were wide, and the temptation to spread his gospel about how to approach nature, how to do research, and how to form new astronomers led him to accept an invitation from Vittorio Canuto and Jerzy Plebanski to work at the Centro de Investigaciones y Estudios Avanzados (CINVESTAV) of the National Polytechnic Institute (IPN) in Mexico City. At that time, the head of the Physics Department was J. Plebansky, an expert in relativity; moreover, Mexico's history and culture held a fascination that was hard to resist, so the young Firmanis, Claudio and Irene, made the great decision of their lives: to come to Mexico and start a new life. In September 1967 Claudio started his work at the CINVESTAV. At the beginning, he wanted to continue the research on stellar evolution which he had started in Rome, but unfortunately his new institute did not have a computer powerful enough to handle the numerical work required, and so he devoted his time to investigate cosmological models with variable G. He also studied the influence of variable G on primordial nucleosynthesis and he published a paper where the Mach principle was incorporated.

Livio Gratton, his professor in Frascati, was a good friend of Mexican astronomers. He suggested to Claudio to get in touch with the Institute of Astronomy at UNAM, which he did very soon after his arrival in Mexico; after a few contacts, we invited Claudio to give several colloquia at our Institute and held exciting conversations about his work and the new discoveries. Astronomy in those days was exploding in all directions. To remember a few highlights: in 1963 Maarten Schmidt discovered the first quasars, in 1965 the cosmic background radiation was observed by Penzias and Wilson, thus confirming Gamow's prediction based on the big-bang model of the Universe, and in 1967, Hewish and Bell detected the first pulsars, establishing the existence of neutron stars. Three fundamental discoveries in 4 years! Most of you remember the great excitement of those days, and the only person in Mexico with whom I could talk about these breakthroughs was Claudio Firmani, whose office was 30 km away at the northern end of the city. So, I began to wonder how we could steal from the Polytechnic Institute this intriguing Italian astrophysicist.

At the end of 1968 I was appointed director of the Institute of Astronomy at UNAM and one of the first things that I did was to invite Firmani to join our Institute. In January 1971, we were finally fortunate to have Claudio Firmani in an office at the Institute of Astronomy of UNAM. My objective was to start at the Institute a research group in Relativistic Astrophysics and to reinitiate at UNAM the teaching of Relativity, which had been abandoned for many years. Claudio was very enthusiastic to undertake this task, and in this way he began to build his group, the school he dreamed about since his days at Rome-Frascati.

4. FROM HEAVENS TO THE GROUND: INSTRUMENTATION

Very soon after Claudio's arrival to our Institute, I was surprised by a proposal he made. As part of his responsibility in developing the Department of Relativistic Astrophysics, he wanted to create a laboratory to build opto-electronic detectors, as well as all the necessary electronic devices. Claudio explained to me that to study all the new high-energy phenomena it was not sufficient to do theory and models, but rather it was absolutely necessary to keep a constant interaction between theory and observation. This is a concept that I subscribed entirely and was more than willing to support it, but nevertheless I kept wondering how this theoretical astronomer, whose experience was in relativity, gravitation, and theoretical stellar evolution, was going to develop a laboratory to build opto-electronic detectors. The first steps were to use Vidicons (TV camera tubes). At that time, a commercial system, the OMA (Optical Multichannel Analyzer), which initially was not sensitive enough for astronomy, was purchased by the Institute with the idea of taking advantage of some of its components, and after several improvements, particularly of the electronics, to obtain a detector much more sensitive than the photographic plate. After a couple of years, by 1974, a totally new OMA-UNAM system was available to be used with the spectrographs at the Tonantzintla telescope and, since 1980, at the 2-m telescope in the San Pedro Mártir Observatory. With the OMA-UNAM, more than a score of papers were published. The success of the Optical Multichannel Analyzer and the experience gained led Firmani's group, in 1979, to launch the development of the Microchannel Electron Position Sensor, or MEPSICRON. In 1978, Carrasco and Firmani designed a new echelle spectrograph and Claudio was excited with the idea to create a new two-dimensional, high-resolution, zero-noise photon counter, to upgrade the echelle-spectrograph at the 2-m telescope for extragalactic observations. It was ambitious indeed, but Claudio and his collaborators succeeded. By 1982, the Mepsicron was a success, and a paper describing it was published that year in the Review of Scientific Instruments. Moreover, at the Annual Meeting of SPIE in London in 1982, Claudio presented the Mepsicron. It was *the* instrument at that meeting, since it represented a quantum jump as the best opto-electronic detector available at that time for Astronomy. From 1983 to 1985, the Mepsicron was in use at San Pedro Mártir. Its success motivated several groups to request the construction and purchase of several Mepsicrons. However, the laboratory was not prepared for a commercial production. Because of the development of the Mepsicron, the first University Annual Prize in Science and Technology was granted in 1986 to Firmani and his collaborators: Elfego Ruiz and Gianfranco Bisiacchi.

5. MORE DEEPLY INTO THE GROUND: FIRMANI THE ADMINISTRATOR

As recognition to Claudio's leadership and success in instrumentation, in 1989 the University authorities appointed him Director of the Center of Instruments. At that time this center was basically oriented to give maintenance to the instruments of various research institutes. During his two-term directorship, Claudio transformed the center into a research and development institution. At present, the center has a strong group of scientists and technicians.

During his directorship at the Center of Instruments, Claudio was involved in additional administrative chores of particular relevance for the academic life of the University.

6. BACK TO HEAVENS

During his period as director of the Center of Instruments, Claudio displayed a frantic activity in many fronts, though he never stopped doing research in Astronomy. In fact, he gradually moved to the grand design approach, i.e.: to understand the evolution of galaxies from the conditions prevailing at the Big Bang.

Claudio became increasingly motivated to understand the formation of structures from density fluctuations in the Big Bang. Of course, the role of dark matter was fundamental in the whole process, hence no wonder that after finishing with his responsibility at the Center of Instruments, he declined a number of invitations that would have distracted him from Astronomy. Instead, he took an extended sabbatical in New Mexico and Italy, where he devoted all his time and energy to study the process of formation and evolution of galaxies in a cosmological context, as well as stellar formation and evolution in the potential well of dark matter halos. One of the topics that had caught Claudio's attention was how to reconcile the predictions from purely deductive models of cold dark matter with the observations of rotation curves in galaxies, in particular, in dwarf and low surface-brightness galaxies, where rotation curves reveal more neatly, without much interference from luminous matter, the potential (and the density profile) produced by the dark halo. As is well known, cold dark matter deductive models predict a very steep rise of density towards the center of galaxies, contrary to what the observations are revealing. The proposal that has been advanced by some authors is that CDM is composed of weakly self-interacting particles (as opposed to the standard, totally collisionless particles). Firmani and collaborators have gone a step further by noticing, on the basis of a very limited observational sample, that the central densities of dark matter halos remain practically constant across the whole range from dwarf galaxies to giant clusters of galaxies. This has led Firmani and collaborators to propose that dark matter is composed of weakly self-interacting particles with a cross section of interaction inversely proportional to the relative particle velocities.

Firmani's paradigm consists in realizing that the observed properties of galaxies are very important fossil evidence of the nature and conditions of the early Universe. In this spirit, Claudio and his collaborators have developed a self-consistent model of disk galaxy formation and evolution, aimed at connecting the initial cosmological conditions to the observed properties of the most abundant population of galaxies in the present. The virtue of this model is that it synthesizes ingredients from both the deductive and the inductive approaches.

Because of family reasons, and with great sorrow, Claudio has left his beloved Mexico. At the University we are sad at the Firmanis' departure. Through Claudio's work and ideas, through his former students and friends, we still maintain his presence among us. Because we are proud and grateful that Claudio spent more than half of his life contributing to the development of Mexican astronomy and technology, the National University recently granted him the degree of Distinguished Professor. Back in Italy, he has found a warm and stimulating atmosphere at the Astronomical Observatory in Brera-Merate, where they received him with well-deserved honors; in fact, recently he has been made Emeritus Astronomer.

Claudio has always been convinced it the importance that society should be well informed of the scientific discoveries and technological advances, both for the pleasure of understanding as well as for the benefits to humankind. No wonder then that he is continuing now, in Italy, the popularization of Astronomy which he did so succesfully while in Mexico. Claudio is truly enjoying his change of life, where he is totally free to devote himself to the present exciting phase in the development of our understanding of the Universe. In his own words: "... since 1980, with the advent of the concept of the inflationary Universe, we are on a sort of a scientific revolution comparable to the Copernican Revolution..." Indeed, very appropriately, we have entered into an inflationary phase since 1980!

Claudio, Irene, your friends an colleagues wish you all the best in your new endeavours, as well as a long life.

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