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Giancarlo Noci: his science and personality. A tribute for his 70th birthday.

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Abstract. The scientific achievements of Giancarlo Noci are here summarized starting from his first steps as a student and young scientist in Arcetri and going on to his more recent success in space science investigation. His scientific life and personality is highlighted through the words of friends and colleagues who recollect different episodes of their relationship with him.

1. Introduction

The present Meeting of the Italian Solar Physics Society opens up with a tribute to Giancarlo Noci, who recently turned 70. It is my pleasure to go briefly through the scientific career of Giancarlo and to illustrate the role he had within the Italian solar physics community throughout many years. I'll also try to outline his personality, because I believe individual traits have an impact also on how science is handled.

2. First steps in science

The name of Giancarlo Noci is first mentioned in the annals of the Arcetri Observatory in the late '50s, when he started working on his thesis. It was a spectroscopic research on the partition function of the neutral Na: we may say that his first, never to be forgotten, love, was spectroscopy and this accompanied him throughout his scientific life. A paper based on his thesis was published in 1957 (G. Noci and M. Rigutti (1957)) and shortly after he started taking part in one of the routine duty of the Arcetri personnel: to make daily observations of the Sun, which implied drawing sunspots, as seen in white light, and recording the H_α prominences shape as seen in the Amici telescope. This activity followed in the steps of previous scientists in Arcetri: we remind the reader that it was Giorgio Abetti who built in Arcetri the second solar tower in Europe.

On february 15, 1961, Arcetri had a unique opportunity: the observatory was in the totality path of a solar eclipse. This gave scientists a chance of using the local instrumentation to follow the event with no need to move instruments to possibly inhospitable locations. Giancarlo Noci, however, was member of a team who took a non-traditional approach: Guglielmo Righini (the observatory director at that time) followed the eclipse from a C119 cargo airplane, which carried four different instruments to observe the eclipse. The

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flight left from Pisa and reached an altitude of $\approx$ 5000 m: the scientific team included Giancarlo Noci and Franca Drago. In his yearly report of the activity of the Observatory, prof. Righini thanks his "travel companions, drs. Noci and Drago, who bravely faced the troubles and risks of this observing program". Perhaps we may consider this "high altitude" observations as an omen of the future research of Giancarlo in space physics.

Another innovative activity started in the '60th at Arcetri: NRL had launched a series of satellites, dubbed SOLRAD, measuring the integrated X-ray radiation from the Sun. The signal from SOLRAD was received and recorded on a magnetic tape in Arcetri: the final tracing looked like an electrocardiogram. Scientists took turn to be at the Observatory at each passage of the satellite over the sky of Firenze to maneuvre the antenna and receive the signal: Giancarlo Noci was a member of the team.

This brief account of Noci's beginning would not be complete without mentioning his interests in radioastronomy. Arcetri had several radiotelescopes, the largest being a 10 meter paraboloid, installed around 1963/1964. Noci used to take part in the data analysis (the 1961 eclipse, for instance, was observed also at radio wavelengths, see F. Drago, G. Noci and C. Chiuderi (1964)) and, although sporadically, he kept an interest in radio astronomy, documented by a number of papers, which extend to about half of the '70s (C. Chiuderi, F. Drago and G. Noci (1964), C. Chiuderi, F. Drago and G. Noci (1964), G. Noci (1976).

3. New scientific frontiers

At those times, scientists didn't travel much: mobility and exchange of ideas between different institutions were occurring at a lower pace than we are used to today. However, in the '60s and early '70s, Noci moved to foreign laboratories/universities, where he spent long term visits and developed an interest in solar instrumentation.

In the first of these visits he spent some time at the Culham Laboratory, in 1966, thanks to an ESRO (today's ESA) scholarship. He was involved in a project aimed at building an echelle spectrograph for solar physics research in X-rays. It was after this experience that Noci started a collaboration with the Harvard College Observatory which is continuing to these days. This is how John Kohl narrates his years of fruitful collaboration with Giancarlo:

"It has been my great fortune during the last 30 years to be associated with Giancarlo Noci in several projects aimed at the development of ultraviolet coronagraphic spectroscopy of solar wind and CME source regions. Our association began in the early 1970's when Giancarlo became interested in measuring solar wind outflow speed with the Doppler dimming method. His early attempts with rocket observations of the 1970 eclipse led to the development at Harvard Smithsonian of instrumentation to carry out such measurements without a natural eclipse. As this work evolved from sounding rocket instruments to flights of the Shuttle deployed Spartan satellite to UVCS/SOHO, everyone envolved benefitted immensely from Giancarlo's wisdom, knowledge and diplomatic skills....It might be interesting to know that it was Beppe Colombo who first encouraged Giancarlo and I to develop ideas for new collaborative projects."

4. Scientific objectives

The words of John Kohl illustrate some of the scientific issues which most attracted Giancarlo's interest during his association with the Harvard College Observatory. It may be worth reminding the reader of some other research in which Giancarlo played a primary role.

In the early '70s the OSO satellites provided long term data on *coronal holes*, now familiar features but quite mysterious areas at the time, to be referred to as M (from mysterious) regions. These were identified by Krieger et al. in 1973 (see A. S. Krieger, A. F. Timothy and E. C. Roelof (1973)) as the sites where high speed wind streams

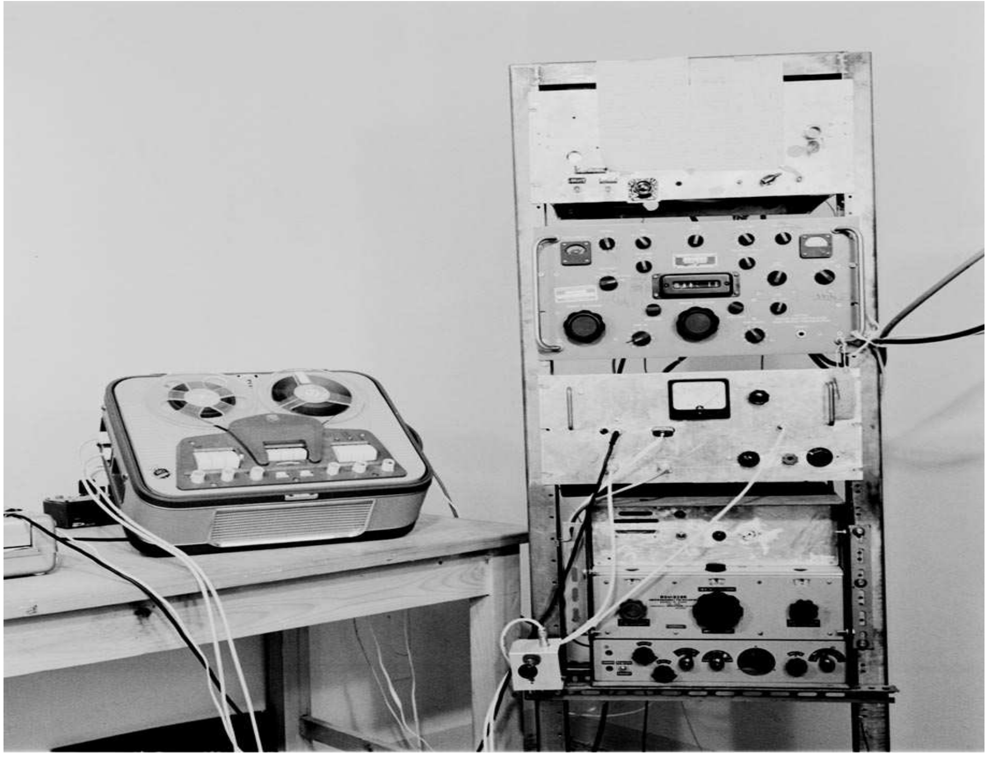

Fig. 1. The Yagi antenna and the receiver used in Arcetri to receive and record the signals from the SOLRAD satellites which measured the integrated radiation from the Sun in several X-ray bands.

originate. A further piece of evidence in favor of this identification was provided by Giancarlo Noci and Barbara Bell, from the analysis of geomagnetic data (B. Bell and G. Noci (1973), B. Bell and G. Noci (1976)). In a previous work Noci had shown that theoretical arguments (a comparison between the energy budget in quiet and coronal hole regions) naturally lead to the conclusion that CH should be identified with the sources of the fast wind (G. Noci (1973). The association fast wind - coronal holes was suggested, for the first time, in this paper).

In a different research Noci considered an issue which is still far from being solved (G. Noci (1981), G. Borrini and G. Noci (1979)): which is the relationship between coronal and *in situ* abundances and how do coronal abundances behave as a function of the topology of coronal holes? It is worth noticing that this work was carried out at a time when the only heavy ion observed *in situ* was He III.

The broadening of Noci's interest to include the interplanetary space is testified also by his active participation in the *Out of Ecliptic Mission*, now well known

Fig. 2. Giancarlo Noci, with Ester Antonucci and Pino Tondello, at Cape Kennedy, in 1995, on the day of the SOHO launch.

as the *Ulysses* mission. This started being discussed around '75 by ESRO and NASA and had a troubled history which ended with the successfull launch of the spacecraft in 1990. In addition to the different instruments the mission carried two interdisciplinary projects, with no links to any particular experiment, one of which – the "Ionic composition and mass loss of the solar wind" – was lead by Giancarlo.

In the '80s Noci worked also on the spectroscopy of coronal plasma, and once more he dealt with problems that are still unsolved, such as the non-equilibrium conditions of coronal loops plasma (**?**, G. Noci and F. Zuccarello (1983), G. Noci, D. Spadaro, R. A. Zappalà & S. Antiochos (1989), G. Noci, D. Spadaro, R. A. Zappalà & S. Antiochos (1990)); he was interested also in static loop models (S. Antiochos and G. Noci (1986)). Next he moved to the solar wind, pointing out the validity of the Doppler dimming technique for its diagnostic (G. Noci, J. L. Kohl and G. Withbroe (1987)). This had a central role at the time of planning the UVCS spectrograph.

5. The SOHO adventure

Moving now to recent years, I will briefly go through the most crucial steps that lead to the SOHO mission. First proposed in 1982, the phase A study was completed in 1985. In 1986 SOHO was included in ESA "*Space Science Horizon 2000*" and the first Announcement of Opportunities was released in 1987. Mission PIs first met in 1988 and SOHO was launched in 1995.

SOHO, with UVCS, gave Italy the opportunity for a rise in the quality of its participation in the space missions: it was the first time that Italy provided hardware and not only an help in the analysis and interpretation of solar space data. Italy had the responsibility for the UVCS spectrometer procurement and Noci became co-PI of the experiment. Noci's role in this process may be inferred from the concise description of Giancarlo given by Martin Huber,

for many years director of the ESA Space Science Department
"a very quiet powerhouse".

I will not spend more words on science from UVCS as this is well known to the solar community and it has accompanied us through these latest years. Bibliography is vast and easily accessible. The Italian solar physicists acquired more visibility thanks to the UVCS experiment, which provided, and still provides, a common research ground for scientists from many Italian institutions. Giancarlo has been the reference point for all collaborations that started around UVCS.

I may terminate this section with the words of Roger Kopp, co-I on UVCS and long-term friend of Giancarlo:
"Giancarlo Noci is certainly one of the (if not THE) most influential and well known Italian solar physicist of our generation, and I will forever cherish having had a close association with him."

6. The teacher at University

Noci started his teaching experience soon after he entered the Arcetri observatory collaborating with Gugliemo Righini, who gave a course in Astronomy. He became "assistant professor" in 1960 and full professor in 1984. Throughout these years he gave courses in many subjects, from "Cosmology" to "Spectroscopy" and "Space science". Many of his students became well known in astronomy. Among these, we may quote Stefano Livi, Grazia Borrini, Egidio Landi, Daniele Spadaro.

I have personal recollections of the lessons I took in the course Giancarlo was giving – spectroscopy – at the time I was a student. As many of you know, he speaks very softly and his lessons were always very quiet and well thought: at times this thinking was due to his need of reconstructing something whose final outcome he didn't remember by heart at the moment. We realised memory was not a necessary prerequisite in physics, but we didn't appreciate too much the time he was taking to get to the final result: his lessons, given late in the evening, often started after the scheduled time and we were impatiently looking forward to our dinner and some rest. He seemed to be totally unaware of our feelings...

Egidio Landi recalls those times with these words
"I met Giancarlo Noci in 1970, when I had to choose my thesis advisor. At the time his name was popular among students. Rumor had it that girls had better chances than boys to graduate with him, that he was wearing only british clothing and that he was a "weak particle", as far as the interaction with students was concerned....All these infamies turned out to be altogether unjustified, although I have to say that during the time I took to write my thesis I saw him no more than 3 or 4 times, but maybe it was my fault or maybe I didn't need to see him...
Time has gone by and things are so changed that we now interact like massive nuclei rather than like neutrinos. We changed from weak to strong interaction and discovered many common interests from bike tours to soccer matches .... And I always appreciated the brightness and inventiveness of Giancarlo's mind, both in daily life and in scientific work..."

Giancarlo succeeded in what all teachers dream: to become a cherished friend of one's own students.

7. Noci's personality

The previous sections, focussed on Noci's scientific activity, have nevertheless given a few hints of his personality: his quietness and creativity emerge from the goals he reached silently and from the problems he faced, ahead of the time when they became "fashionable". For somebody non familiar with him, his quietness may be misleading. Here is what R. Kopp says:
"One thing I can remember being impressed with is seeing him apparently doze through most of a seminar but then suddenly pose a perfectly rational and well-

thought-out question or comment to the speaker during the discussion period."

This apparent absentmindedness is a peculiar characteristics of his personality which complies with the stereotype of the physicist whose mind roams the sky, rather than the earth. Sometimes, this has drawbacks in ordinary life. Spiro Antiochos recalls a hike he took with him
"I've been on many hikes with many people in my life, but none was more fun than wandering lost in the wilds of Viterbo with Giancarlo.. I wish I were with him there now."
Apparently, the drawback turned a hike into an unforgettable experience!

John Kohl reveals other unexpected traits of Giancarlo:
"Through all of this time, I have experienced Giancarlo's scholarship, sense of humor, genuine sincerity, interest in people, and generosity. I am happy to say that I have also experienced some results of his culinary skills both at his home in Florence and on a canoe trip through the deep woods of Maine. Of all his diverse characteristics, the most impressive is his generosity which I have benefitted from in his scientific pursuits and have witnessed on numerous occasions when he encountered needy people on street."

It's hard to give an image of a person through few words and a necessarily incomplete account of his life. Nevertheless, I hope I have been able to make the audience aware both of the scientific achievements of Giancarlo as well of the more distinguished traits of his personality, as seen by the people who have been associated with him through the years. I would like to end this contribution wishing Giancarlo all the best for the exciting scientific experiences he is involved with at present. I also hope he will keep all the characteristics that make him such a special person among friends and colleagues.

Acknowledgements. It is my pleasure to thank the friends who took time to write down and to send me their memories of Giancarlo Noci, thus contributing the material that allowed me to give a portrait of his personality.

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