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Memorie della

Concluding address

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Abstract. Before to conclude officially this workshop — far from me the idea to attempt some concluding remarks already well done by Guennadi Bisnovatyi-Kogan and Janusz Ziołkowski —, I would like to comment few highlights coming out from our fruitful week of discussions about *multifrequency astrophysics*, without any pretension of completeness.

Key words. Multifrequency Astrophysics

The propagation of Professor Livio Gratton's ideas produced a sort of explosion — dated 1961, when he came at La Sapienza University in Roma for the newborn chair of astrophysics, thanks to the intuition and patronage of Professor Edoardo Amaldi and the Senate —, like that of a supernova, whose remnants are the numerous his pupils, all of them rather well known within the international astrophysical community. Figure 1 shows the sketch of such an explosion.

Since that time, professor Gratton was able to catch the interest of many young promising physicists, who definitively demonstrated to be worthy pupils of him. Within this framework the 'Laboratorio di Astrofisica' (now 'Istituto di Astrofisica Spaziale e Fisica Cosmica') officially born in 1970, as one of the most prestigious laboratory of the Italian CNR (National Research Council). Soft X-ray experiments on board rockets were successfully prepared and launched in 1969, 1971, and 1975. Numerous hard X-ray experiments were also successfully prepared and launched on board stratospheric balloons, starting in 1976 with HXR–76 experiment aboard a transatlantic balloon lauched from the Milo base (Sicily, Italy). At the same time, a prestigious school of stellar evolution was born, together with experimental infrared, optical and ultraviolet astronomy, as well as a school of relativistic astrophysics. Thanks to the many experimental activities spread along the whole electromagnetic spectrum, the *Multifrequency Astrophysics* became one of the most important topics developed in our laboratory. This was the reason because I organized the pioneering Frascati Workshop about *Multifrequency Behaviour of Galactic Accreting Sources* in 1984 (F. Giovannelli (eds.), 1985) as unique member of the scientific committee and chairman of the local organizing committee whose other two components were Miss Lidia Barbanera who managed the whole workshop and Mr Massimo Frutti for the technical assistance.

This year, 2009, we have celebrated the *Silver Jubilee* of the Frascati Workshop Series.

As far as we know, the first workshop devoted to multifrequency observations of galactic cosmic sources was held in Vulcano in

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Fig. 1. The supernova 'Livio Gratton' produced remnant–pupils, all of them rather well known within the international astrophysical community.

1984. The proceedings of that pioneering workshop are a clear example on the necessity of this kind of observations in studying cosmic sources (Giovannelli, 1985). In spite that 25 years passed since that time, during which enormous developments in technologies have been realized and then usefully applied to astronomy, a part of the '84 open problems are still open.

Although extragalactic astronomy, meanwhile improved a lot, did neither cancel nor reduce the interest in galactic astronomy on the contrary to what the powerful 'extragalactic scientific lobbies' would like to obtain.

Indeed, the concluding remarks of the first workshop, I will resume in the following, are still valid:

– **Wolfgang Brinkmann** said: ... *Roughly one or two years ago one could get the impression that all interest in high energy astrophysics was moving towards the study of extragalactic objects. Therefore it was a great pleasure for me to see on this workshop how much work is still going on in the field of galactic accreting sources. In particular I was very impressed to learn about the enormous efforts put into long term observing programmes in the radio, IR, optical, UV, X-ray frequency ranges (for example on A 0535+26 or on SS 433) which take so much of time but which are in many cases absolutely necessary to get more insight into the physics of these sources. I think it became clear in our discussions that there is still a lot of work to be done and, in particular, that many of the "well established" simplified models for these sources will have to be reconsidered in the light of extended observations over a broad energy range*;
– **Michael Friedjung** said: ... *I would like to end on a note of caution. Novae have been observed for many years, and are still badly understood. Other objects which have been more recently discovered such as gamma-ray bursters and Geminga are much less observed, but this has not stopped a lot of theoretical modeling. There are often fashions in models and a "bandwagon effect. There can be an almost "political influence when certain colleagues succeed in imposing their ideas on others ...*;
  It seems that it was written just as foresight of the history of GRBs !!!
– **Joe Smak** said: ... The overall usefulness of a conference defined by the physical process(es) rather than by the type(s) of objects;
– **Franco Giovannelli** said: ... *This workshop has clearly demonstrated that the simplified models for the accreting sources must be revisited in view of the simultaneous multifrequency observations, which are the only deep method of analysis of the internal physical processes in these systems.*

We can say now that all these remarks are still valid and during this workshop devoted to high energy cosmic sources we have had the proof.

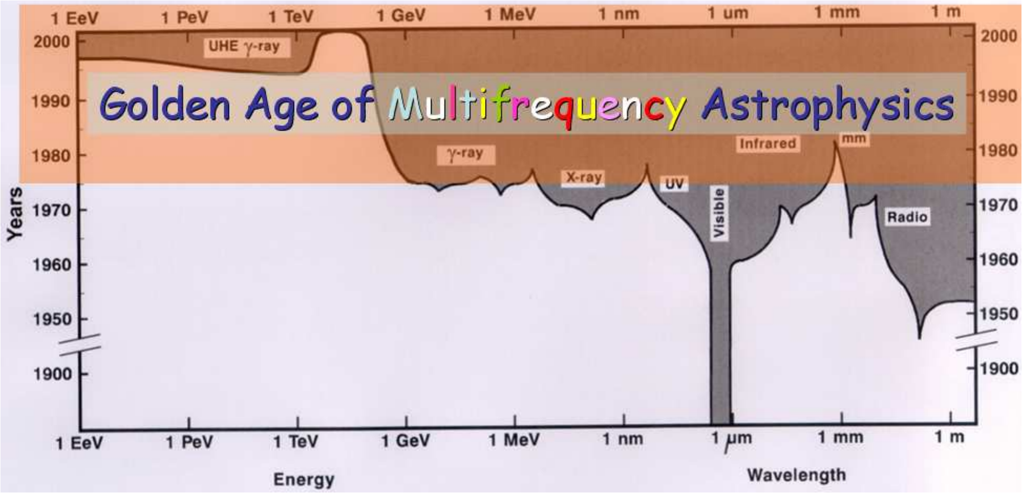

Fig. 2. Amount of astronomical data acquired across the electromagnetic spectrum during last century (Giovannelli & Sabau-Graziati, 2004, updated from Lena, 1988). The Golden Age of multifrequency astrophysics born in the middle 1970ies.

Undoubtedly the advent of spacecrafts gave a strong impulse to astronomy; starting roughly from middle 1970ies almost all the electromagnetic spectrum was continuously surveyed by the many space experiments. A large amount of excellent-quality data coming from space experiments rendered the data, acquired during many centuries from the ground, only a small fraction of the total now available (e.g. Giovannelli & Sabau-Graziati, 2004). Then, **The GOLDEN AGE of Multifrequency Astrophysics** began, as sketched in Figure 2 (Giovannelli & Sabau-Graziati, 2004, updated from Lena, 1988).

Multifrequency observations are now considered by the whole community essential for a better understanding of the physics governing the universe. Our pioneer campaigns (since middle 1970ies) of multifrequency observations and our workshops on Multifrequency Behaviour of High Energy Cosmic Sources have contributed to the advance on our knowledge of the universe.

The prospects for the future are a clear convergence of the 'photonic astrophysics' and 'particle physics' into the *newborn astroparticle physics* field.

Indeed, as discussed in the introductory paper of this workshop, photonic astrophysics is moving to higher and higher energies , and particle physics also is moving to the highest energies of the cosmic-ray spectrum (Giovannelli & Sabau-Graziati, this volume, Figures 30, and 33, respectively). The sensational news coming from FERMI observatory in its first three months of life clearly demonstrate the importance of the measurements at GeV energies. Indeed, Fermi detected 205 sources at > 10 σ confidence level, whilst EGRET found only 31 such sources in its entire lifetime (~ 10 years).

After this workshop it appears evident, once more, the importance of Multifrequency Astrophysics. However, there are many problems in performing Simultaneous Multifrequency, Multisite, Multiinstrument, Multiplatform measurements due to: i) objective technological difficulties; ii) sharing common scientific objectives; iii) problems of scheduling and budgets; iv) politic management of science.

In conclusion, during this fruitful workshop, we hope to have demonstrated once more the *Vulcano Theorem* enunciated in 1984 in my concluding address: **It is possible to develop science seriously even if smiling**.

Acknowledgements. On behalf of the SOC and LOC, I am pleased to thank all participants and es-

pecially the speakers for their active contributions in rendering this workshop updated with their talks, alive with their discussions, and friendly with their attitudes. I hope to meet all of you once again during our next Frascati Workshop.

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