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# Concluding Address

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**Abstract**

Before I officially conclude this workshop — far be it from me to attempt to compete with some concluding remarks already delivered at the meeting with various levels of passion by Gennady Bisnovatyi-Kogan, Giulio Auriemma and Sergio Colafrancesco — I would like to comment on some of the highlights emerging from our fruitful week of discussions about *Multifrequency Behaviour of High Energy Cosmic Sources*, without any pretension of completeness.

**Keywords:** photonic astrophysics - particle astrophysics - neutrino astrophysics.

Undoubtedly the advent of spacecraft gave a strong impulse to astronomy. Starting roughly in the mid 1970s, almost the whole electromagnetic spectrum has been continuously surveyed in a large number of space experiments. Astroparticle Physics, a new field of physics, was born roughly twenty years ago by joining the efforts of the High Energy Astrophysics community and the Particle Physics community. During this relatively short period of time, Astroparticle Physics has developed strongly through studies of cosmic sources that are emitters of photons, charged particles, and neutrinos. Some of the sources could produce gravitational waves that will probably be detectable in the near future with the new generation of ground–based gravitational experiments, such as LIGO, and space–based experiments, such as LISA. Meanwhile the large hadron collider (LHC) has been producing excellent results on the Higgs boson, and in general about the study of pp collisions at TeV energies, never obtained before in ground–based laboratories. These results, together with the results coming from the Hubble Space Telescope (HST), with its deep survey of faraway objects of the Universe, and with the VHE emission detected from a number of cosmic sources, both galactic and extragalactic, are witnesses of the validity of the Big Bang theory, described by the standard model.

Among many experimental and theoretical results discussed during this workshop, I would like to mention a couple of them that, in my opinion, will underpin the future of astroparticle physics.

The first is the VHE sky at energies $E_\gamma > 100$ GeV. About 150 TeV sources have been detected (see Fig. 1, http://tevcat.uchicago.edu/). Only 20 years ago, this sky was practically empty. It is expected that over the next decade the ongoing operation of Fermi will be accompanied by observations with the current ground–based H.E.S.S., MAGIC, VERITAS experiments and the planned CTA and HAWC experiments. Data obtained in the very wide energy range from 100 MeV to 1 PeV will provide very deep insights into a number of problems of high-energy astrophysics and fundamental physics (see the review paper about TeV astronomy by Rieger, de Oña-Wilhelmi & Aharonian, 2013).

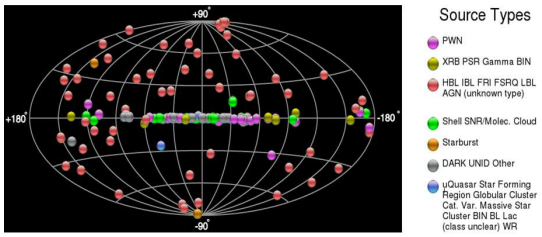


**Figure 1:** TeV sources catalog (http://tevcat.uchicago.edu/)

The second is connected with the reionization epoch of the Universe at $z \approx 20 - 30$, when the first stars appeared (e.g. Lamb & Reichart, 2000; Ciardi & Loeb, 2000; Bromm & Loeb, 2002). Therefore, quasars and GRBs could be detectable up to roughly that epoch. Type–Ia supernovae (SNe Ia) have been detected up to $z \approx 1.7$; the future JWST will be able to detect SN Ia in the range $1.7 < z < 3$ (Aldering et al., 2007). Quasars have been detected at $z = 6.419$, 6.43 (Fan et al., 2003), and $z = 7.085$ (Mortlock et al., 2011), and GRBs up to $z = 9.4$ (Cucchiara et al., 2011). These detections support the theory fixing the reionization epoch to $z \approx 20 - 30$ (see Fig. 2).

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

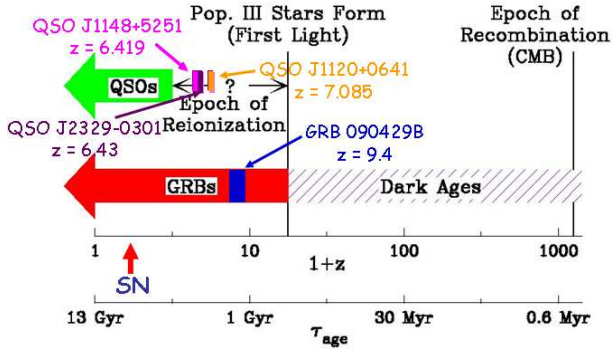


**Figure 2:** Sketch of the evolution of the universe from the epoch of recombination up to the present time. The epoch of reionization is also marked (after Dai Zhigao, Nanjing University). The positions of the highest z quasars and GRB are superimposed.

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

And finally, I would like to conclude with a few wonderful words of Dr Daisaku Ikeda (2001)–president of Soka Gakkai International (SGI)–reported in the booklet *For Today and Tomorrow* - the thought for May 30th:

"*Whoever has many friends has greater opportunities for growth. In this way, one both makes society a better place, and lives happier and more satisfied. In all cases, human relations, interpersonal interaction and communication are of vital importance. We must establish and nurture friendship and contacts with many people, both in our environment, and in society in general.*

*In this manner our life will open up and will flourish*".

We could go back to early childhood when we were like the Little Prince.

One sees clearly only with the heart. What is essential is invisible to the eye (from The Little Prince, by Antoine de Saint Exupéry).

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Finally, on behalf of all participants, I would like to express my warm thanks to the Chef, Mr Daniele Inzerillo, who prepared a large number of delicacies for us.

I hope to meet all of you once again during our next Palermo Workshop.

## References

[1] Aldering, G. et al.: 2007, Astropart. Phys. 27, 213. doi:10.1016/j.astropartphys.2006.11.001

[2] Bromm, V., Loeb, A.: 2000, ApJ 575, 111. doi:10.1086/341189

[3] Ciardi, B., Loeb, A.: 2000, ApJ 540, 687. doi:10.1086/309384

[4] Cucchiara, A. et al.: 2011, ApJ 736, 7. doi:10.1088/0004-637X/736/1/7

[5] Fan, X. et al.: 2003, AJ 125, 1649.

[6] Ikeda, D.: 2001, *For Today and Tomorrow* - the thought of 30th May, Edizioni Esperia.

[7] Lamb, D.Q., Reichart, D.E.: 2000, AIP Conf. Proc. 526, 658. doi:10.1063/1.1361618

[8] Mortlock, D.J. et al.: 2011, Nature 474,616. doi:10.1038/nature10159

[9] Rieger, F.M., de Oña-Wilhelmi, E., Aharonian, F.A.: 2013, Front. Phys. 8(6), 714. doi:10.1007/s11467-013-0344-6