PROCEEDINGS OF SCIENCE

Concluding Address

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Before officially concluding this workshop (and it is far beyond my powers to attempt some concluding remarks beyond those already dealt with on the various burning questions presented by Joseph Patterson, Dmitry Bisikalo, Joanna Mikolajewska, and René Hudec), I would like to comment on a few highlights coming from our fruitful week of discussions about *The Golden Age of Cataclysmic Variables and Related Objects - III*, without any pretension of completeness.

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[†]A footnote may follow.

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1. My Personal Comments

Undoubtedly the advent of space-based observatories has given a strong impulse to astronomy. Starting roughly from the mid-seventies and over almost all of the electromagnetic spectrum, these observations have continuously surveyed the sky. Cataclysmic variables (CVs) historically were the first systems that demonstrated the need for studies of the accretion disk processes around white dwarfs (WDs). In fact, these studies began in the early 1960's with the schools of Warsaw (Poland) and Cambridge (UK). However, they rapidly lost their primeval importance because of the advent of the first X-ray space experiments that, with their limited sensitivity, were mostly detecting X-ray binary systems (XRBs). These showed abundant X-ray emissions avove the thresholds of their detectors. Of coure, we now know that these sources emitted brightly thanks to the presence of neutron stars or black holes as companions of the optical low–mass or high–mass stars. The X-ray emission of CVs is about 2–3 orders of magnitude lower than that of XRBs. Thus the bulk of observations of CVs for a long time came from optical and UV regions, and sometimes from IR and occasionally from radio bands.

In the last decade, results coming from the new generation of satellites, especially in the hard X–ray and γ–ray regions, renewed the interest of scientific community on CVs. This, together with the new developments in searching for the progenitors of type Ia supernovae was the main reason for a new explosion of interest in CVs.

This week of deep discussions about CVs and related objects has centered around the physical processes occurring inside those systems. The meeting has shown the most powerful way for a better and faster development of our knowledge of the cataclysmic processes, which are rather usual in the Universe.

Among the many experimental and theoretical results discussed during this workshop, I would like to remark on one important, old idea developed by Vladimir Lipunov in the 1980's, that, in my opinion, will stress the importance of the future of CVs physics.

Of course, this work by Lipunox is the physical description of CVs as gravimagnetic rotators (Lipunov, 1987). In this way the behaviour of CVs is completely determined by the spin period of the WD and the gravimagnetic parameter $y = \dot{M}/\mu^2$, where $\dot{M}$ is the mass accretion rate onto the gravimagnetic rotator having mass M, and μ is its magnetic moment. This is valid also for all compact objects, like neutron stars and black holes. In this way, the behavior of CVs is completely independent of optical phenomena which until now have prevailed in cataloging such systems into different classes. Figure 1 shows a part of Lipunov's diagram where polars (PCVs), intermediate polars (IPCVs) and non–magnetic CVs (NMCVs) are situated.

As discussed by Giovannelli & Sabau-Graziati (this workshop), it appears evident that the most suitable approach for studying CVs from a physical point of view is to consider them as gravimagnetic rotators.

The detection of several SW Sex systems having orbital periods inside the so-called "period gap" opens a new and interesting problem about the continuity in the evolution of CVs. Are the IPCVs and PCVs smoothly connected via the SW Sex-like systems placed just in between?

In order to fully understand the emission properties and evolution of CVs, the mass-transfer process needs to be clearly understood, especially the magnetic mass transfer, as well as the properties of magnetic viscosity in the accretion discs around compact objects. Consequently, the in-

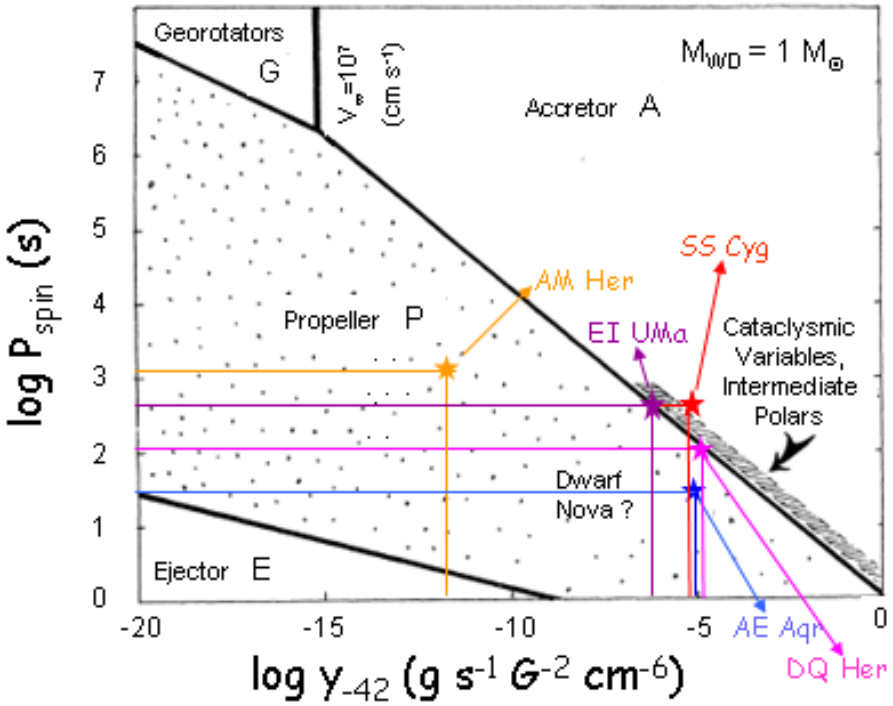

Figure 1: The positions of several CVs in Lipunov's diagram calculated for 1 $M_\odot$ white dwarf (Giovannelli & Sabau-Graziati, 2015 - after Lipunov, 1987).

vestigation on the magnetic field intensities in WDs appears crucial in understanding the evolution of CVs systems, by which it is possible to generate classical novae (e.g., Isern et al., 1997) and type-Ia supernovae (e.g., Isern et al., 1993). In those catastrophic processes, the production of light and heavy elements and then the knowledge of their abundances provides strong direct inputs for cosmological models and cosmic ray generation problems.

2. Some General Remarks

This workshop again affirms the importance of Multifrequency Astrophysics. 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; and iv) the politic management of science.

During this fruitful workshop, we hope to have demonstrated once more the *"Vulcano Theorem"* enunciated in 1984 in my concluding address of the first historical workshop on *Multifrequency Behaviour of Galactic Accreting Sources*: **It is possible to develop science seriously even if smiling**.

But, as you probably suspected, this workshop has been organized under *"Peaceful Surroundings"*. For this reason I want to conclude with a few wonderful words of Dr Daisaku Ikeda (2001a) –

president of the Soka Gakkai International (SGI) – reported in the booklet *For Today and Tomorrow* - the thought of 30th May:

"*The one who 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, inter-personal 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 as the "Little Prince". To quote:

One sees clearly only with the heart. What is essential is invisible to the eye (from *The Little Prince* by Antoine de Saint Exupéry, 1943).

The search for the essential is of extreme interest to a large number of men of great learning. These are in agreement with Paul Salahuddin Armstrong, who said in his 2014 talk "*Human Family; Past, Present and Future*", at the "*New Humanity Movement-Event*" (Paul Salahuddin Armstrong, 2014):

Today we travel the world, making connections, doing business, and building relationships in person or online with fellow members of our Human Family from all parts of the Earth. We are becoming more conscious that what happens in one place affects people everywhere. We are not alone... We are not isolated... Only through building bridges of Love and Understanding can we insure the well-being of everyone in our Human Family.

The search for the essential is so important that even famous, noble-minded scientists try to attempt the difficult way of the possible convergence of science and life in its more sublime meaning. For instance, Pier Luigi Luisi founded in 1985 the *International Week of Cortona "Science and the Wholeness of Life"*, dedicated to the integration of Scientific Disciplines and Humanities. Later he published the book, "*The Emergence of Life. From Chemical Origins to Synthetic Biology* (Luisi, 2006) in which he reviewed the consecutive stages from prebiotic chemistry to synthetic biology, uniquely combining both approaches. Indeed, the origin of life from inanimate matter has been the focus of much research for decades, both experimentally and philosophically. Friedrich Rolle, a German philosopher and biologist, wrote "*The general reasons for this assumption are so categorical that I have no doubt that sooner or later it will be possible to demonstrate such an assumption in an unambiguous and scientific way, or even repeat the process experimentally* (Rolle, 1863).

In the book "*The Systems View of Life: A Unifying Vision*" (Capra & Luisi, 2014) those authors integrate in a single framework of coherent thought the ideas, models and theories that are the foundation of the systemic vision of life, highlighting its economic, ecological, political and spiritual implications.

Personally, I would like to reiterate and underscore some fundamental concepts in the book, which I completely share.

Life is a network of complex and inseparable relationships that renders the understanding of an individual phenomenon indivisible from the understanding the entire ecosystem in which it occurs. Therefore the answers can not be found by relying exclusively to the scientific method. A "holistic" approach is now required, one that is able to reflect on connectivity, relationships and contexts as well as properties and functions of the individual parts.

The discipline that best reflects the systemic vision of life is ecology, which reconnects the life sciences with the earth sciences and studies the interaction of organisms with each other and with the surrounding environment. The new ecological science - that has emerged from organismic biology only in the late twentieth century when the concept of ecosystem developed - is not anthropocentric but eco-centric. That is characterized by the awareness that all living things are tied together in networks of interdependence.

Ecology is the ideal bridge between science and spirituality. In fact, within the systemic view of life, it is essentially the concept of balance between science - responsible for material and technological progress - and spirituality, responsible for the internal growth of individuals and ethical limitations imposed by the excessive consumption of the resources of the planet. The balance between science and spirituality determines the welfare of society.

The Bridge between the Big Bang and Biology (e.g. Giovannelli, 2001) ferries us from the original point to the biologically active side where sentient life and, then science, start. But to close correctly the “run" of it, it is necessary to cross one bridge more: the bridge between science and spirituality. If this bridge is properly covered, our society will flourish.

Personally, I feel obligated to point out some observations that seem fundamental about the philosophical and social implications of contemporary science. These observations lead to interesting conclusions about the origin of life and the self-organization of natural and synthetic systems. These findings are in keeping with the Buddhist view of the Universe. It is understood as a living organism being composed of myriads of components all related and interacting with one another. Life can be seen as a system of interconnected autopoietic systems. The organism interacts with the environment in a "cognitive" way. At the same time, the organism "creates" its own environment and the environment allows the creation of the organism. But this is the concept of dependent origin. According to this concept, every phenomenon is the product of the interaction of every other phenomenon in the Universe.

The consequence of this view are of extraordinary importance, above all in ethics: it asserts that all living beings and their environment are inextricably linked, and that their essence is not absolute but "of relationship". It leads us to respect every individual being and its inherent rights. In other words, this view leads us to live and act without distinguishing our own happiness from that of others. Ultimately this view leads to the **TOTAL RESPECT OF LIFE** in the most general meaning.

3. Conclusions

In this workshop, the presence of women has been particularly pleasant and intentional as well as the presence of many young colleagues, some of them still PhD students.

This is the age of the youth. Young people do not depend on anyone or draw strength from others. The courage of young people is unparalleled. They fears nothing. The courage of youth is boundless, is the strength to never give up (Daisaku Ikeda, 2001b).

Probably the most important scientist and artist ever born, Leonardo da Vinci, said *Tristo è lo discepolo che non supera lo maestro suo!*. Expressed in English, that reads as *Grim is the disciple who does not exceed his master!*

Therefore now, as senior scientist and director of this workshop, I am honored to pass the baton to the next generation. For this reason I invite Miss Mariko Kimura and Miss Mokhine Motsoaledi, the youngest participants, to receive this important poster, shown in Figure 2.

Figure 2: The symbolic baton passed by Franco Giovannelli to next generation scientists.

4. Acknowledgments

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Lola Sabau-Graziati did not come because of the integration of the ASIM Payload at INTA with ESA and other participant countries. Massimo Della Valle did not come because of serious familiar problems. Daniela Giovannini (Biologist) says goodbye to everybody. She left in hurry Tuesday afternoon because of an important experiment in her Institute (CNR/IBCN).

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Without the presence of Francesco and Daniela it would not have been possible to organize the workshop!

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

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