



## **Gallieno Denardo, the Office of External Activities and its integration with the Optics Programmes**

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*In memory of Professor Gallieno Denardo, ICTP Italy*

The Office of External Activities (OEA) was a specialized office of the International Centre for Theoretical Physics (ICTP). It funded and administered scientific activities that took place largely outside of the ICTP campus in Trieste, Italy. These activities included affiliated centers of excellence, scientific networks, visiting scholars programs, as well as support for scientific conferences and schools taking place around the world. All of this at one time was under the overall direction of Professor Gallieno Denardo, and he used the various pieces to provide a holistic approach to development, including the optics program. Later it would also absorb the Training and Research in Italian Laboratories (TRIL) program, providing long-term research and training visits to various Italian laboratories for early-to-mid career scientists from developing countries, with a total annual budget of around 0.75 million Euro. The TRIL Program was created initially by Professor Pino Furlan.

The development of optics and laser physics was of great personal importance for Gallieno and the OEA was an integral part of that development efforts. It was more a labor of love for him, and presumably also a powerful counter-irritant to some other aspects of his work. It might seem odd that he would have become involved in this experimentally-focused area of science in the first place, given that his research interests and training were broadly in theoretical aspects of general relativity. It is easy to understand why he would remain engaged, taking into account the welcoming support he received from leaders in the optics community, including many contributors to this volume, but the right beginnings could perhaps be understood by considering one aspect of the ICTP founder Abdus Salam's thinking about the Center that surely had resonated with Gallieno: As recounted by Prof. Luciano Bertocchi, former Deputy Director of ICTP and interim Director following Salam's death, Salam had encouraged scientists employed at the center to devote some non-negligible fraction of their time and effort to scientific topics that were outside their own area of expertise, those that could have more direct societal relevance and contribute to developing sustainable scientific systems in economically disadvantaged regions of the world. In actuality, the percentage of staff time given in this respect looked good as an average over all scientists at the Center, only because some, like Gallieno, devoted all their time on it. Gallieno created a broad international optics community at ICTP, building appreciation for the topic, despite the fact that the Center had little or no in-house expertise. Dr Miltcho Danailov, originally a TRIL Fellow from Bulgaria, was the main exception to this, recruited later as a full-time scientist at the Synchrotron in Trieste (Elettra), where he has played a critical role in the

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development of Elettra's unique free electron laser. In spite of this activity, he has generously maintained his strong support for the optics program at ICTP.

Gallieno understood the practical difficulties in pursuing leading-edge research by scientists working in developing countries and devised a number of practical schemes that could be used to address them. The administrative vehicle for these programs was OEA, which also funded the programs mentioned above. This was very helpful. Through these programs, Gallieno was able to cultivate personal contacts with scientists throughout the world, to understand what their needs were at a deeper level, and so better inform his actions. These scientists, in turn, felt that he was constructively listening to them, and appreciated what in effect was a longer term collaboration with ICTP through the OEA. All of this helped Gallieno put together more appropriate and holistic measures to help them. Naturally, he hoped to eventually see some return on his investments, largely measured by the success of the students and the research lines that were supported. It was not always the case that he felt assured of the success he had envisioned; it is also fair to say that Gallieno was, in some instances, disillusioned with the results of his experiments, which, to a certain degree, he tended to take personally. This was especially true in the case of optics research, in which he had a personal stake and which he considered an enabling area of research. As such, it was important to the realization of his development goals. One must think that he realized this aspect of optics research from the beginning, but even if he had not, it would have become abundantly clear through his personal connections to leaders in the optics community. Development was not only tied to research, however; it was also connected to improvements in the teaching of physics at the lower levels, although he understood that this was outside of ICTP's primary mandate and would require the diversion of resources otherwise directed at fostering world-class research. However, the Natural Sciences sector at UNESCO was interested in teaching, and Gallieno knew this as he had held discussions at ICTP with Minella Alarcon, a programme specialist in UNESCO with a background in the optical sciences, and two of the contributing authors to this volume, Eugene Arthurs, then CEO of SPIE, and Vasudevan Lakshminarayanan ("*Vengui*"), now at the University of Waterloo, as well as pedagogical experts from Asia, Africa and the US. The outcome from these discussions was the creation of a teacher training program entitled Active Learning in Optics and Photonics (ALOP) which would be an activity reporting to the International Basic Sciences Program (IBSP) at UNESCO.

All of this coincided with another discussion occurring between one of us (KRS), who strategically wanted to find an area of collaboration between ICTP and the Natural Sciences sector at UNESCO headquarters, and the other (JJN) whom KRS suggested should "*have a talk with Gallieno who might have some ideas*". Gallieno had no time to personally follow the project he had worked to create but recognized the strategic value of the collaboration and handed over the notes from the above-mentioned discussion, along with a suggestion that one of us (JJN) might follow it. The program would eventually move from the IBSP to ICTP, managed under the OEA, with the main financial support coming from SPIE and ICTP, in addition to contributions from OSA, ICO, EOS, EPS, Essilor, and others. The program ran successfully in Africa, Asia, Central and South America, up to the Covid-19 pandemic and lockdowns (see the note from Eugene Arthurs in this volume for additional information on ALOP).

Although the bulk of Gallieno's attention, and OEA funding, was to science in Africa, he had a special interest and appreciation for Central European countries, which include the area around and including Trieste, especially countries like Romania which has strong cultural ties with Italy. In particular, Gallieno devoted much energy to creating working links between ICTP and the Central European Initiative (CEI), a regional intergovernmental forum created immediately after the fall of the Berlin Wall, and which had its headquarters in Trieste. The OEA would manage a CEI primary network which included--not surprisingly--a number of optics laboratories, from Belarus to Moldova.



**Photo 1.** Optics and OEA: Teachers-Fellows of the Inter-American Teacher Education Network (ITEN) nominated by their respective national Ministries of Education, attending an ALOP activity in Lima Peru (2019), in partnership with the Organization of American States (OAS). Substantial contributions were provided by SPIE and the Optical Society of America (now Optica). A follow-up activity planned for 2020 in Jamaica was canceled due to the accelerating Covid-19 pandemic.

Considering ICTP's roots in the International Atomic Energy Agency (IAEA) in Vienna (IAEA is part of the tripartite governing agreement and contributed about 10% of ICTP's annual operating budget) Gallieno strategically nurtured the relationship between IAEA and ICTP. One particular program, which emerged in the early 2000s from the Technical Cooperation Program at IAEA, was the Sandwich Educational and Training Program, or STEP. STEP supported doctoral training for developing country students who were actively registered as students in an institution in their home country. What they gained were co-supervisors either at ICTP or in one of the other collaborating institutions of the IAEA, as well as access to libraries, conferences, etc. Both of us supervised several students (from Armenia to West Indies) as part of that program. Gallieno was persuasive in having optics and laser physics considered as an applicable field for this IAEA program, despite its tenuous connection to nuclear physics. Naturally, since this program was administered from the OEA, it provided a huge boost to the optics development work that Gallieno had in mind, having a more direct impact on student development.

The OEA has continued to support initiatives in optical sciences after Gallieno's passing in 2007, including relevant affiliated centers, visiting scholars, outside conference support, TRIL, and STEP. It also served as the Global Secretariat for the 2015 *International Year of Light and Light-based Technologies* (IYL2015) and continues to manage the Secretariat for its legacy initiative, the UNESCO International Day of Light. The ALOP programme was in fact a cornerstone activity of IYL2015 and the OEA managed six workshops around the world that year. The OEA has also become a laboratory of ideas for new programs, mainly connected to early career development. One program, in particular, needs to be highlighted. A few years before Gallieno's passing, both of us had met with Gallieno in the ICTP bar, and over coffee casually

pointed out that he was not getting any younger and perhaps he needed to think about finding someone who could carry on eventually with the optics program, possibly someone who could bring research expertise to the ICTP campus. Gallieno assured us it was too early to worry about such things, and it was clear that he was not keen to relinquish any part of the program which had brought him so much joy, so the chat became just that and not a plan. He did pass away, unfortunately, a couple of years later, and we made immediate plans to ensure that the upcoming Winter College on Optics would proceed as planned. Other programs were likewise followed. There was still an absence of any in-house expertise in the topic, which limited the extent of service to the global community. Knowing that pressure from other established research sections would make the hire of an expert—to run experiments especially—problematic, Eugene Arthurs later proposed to help fund an “anchor” at ICTP to provide on-campus advanced training and research that would integrate naturally with the Optics Colleges and other programs of the OEA. This became the SPIE-ICTP Anchor Research in Optics program, which is one of the most successful programs of the OEA today.



**Photo 2.** Optics and OEA: A few members of the Trieste System Optical Sciences and Applications board (TSOSA)—established by Gallieno to provide advice on the optics programs—gathered in 2015 around the embryo of the present Optics Laboratory with its focus on thermal lens spectroscopy. Major equipment for this research line was provided through a grant from the OEA, augmented with general purpose instruments from the ICTP Turbulence Laboratory and contributions from the laser laboratory at Elettra, headed by Miltcho Danailov. **Photo:** (Left to right) Angela Guzman, Mario Bertolotti, Anna Consortini, Maria Yzuel, Vasudevan Lakshminarayanan, and Maria Calvo.

In a nutshell, the idea was to hire a post-doctoral associate to conduct research at ICTP and to be available for working with early career developing country scientists or their students, all with varying technical backgrounds. It was difficult to find the right person for this, but with the joining of a Cuban-born researcher, Dr Humberto Cabrera (see Humberto’s article in this issue), ICTP had the anchor that was originally envisioned, and then some. Today, the ICTP optics laboratory is situated in Multidisciplinary

Laboratory on the ICTP campus, and hosts around a dozen young researchers every year for career-enhancing visits of two or more months. They visit, for example, with TRIL and STEP Fellowships, or other schemes managed by the OEA and/or related to the many external collaborations throughout the world that Humberto has set up. In addition, Miltcho and Humberto have worked together to provide additional research experience at Elettra for selected trainees after their initial visit to the ICTP optics lab.

Humberto does not have a permanent position at ICTP, but he has accomplished things that would have Gallieno smiling, making up for that limitation by keeping himself at the top of his research area (a prolific reviewer, he averages nearly one manuscript per week), and being in equal measures diplomatic, clever, collaborative, and, most of all, extremely hard-working, expecting this latter attribute to be adopted by all the young scientists he trains in the laboratory, and reinforcing it by example. The optics laboratory, with Humberto's coordination and SPIE's support, has become a fitting legacy to Gallieno's efforts.

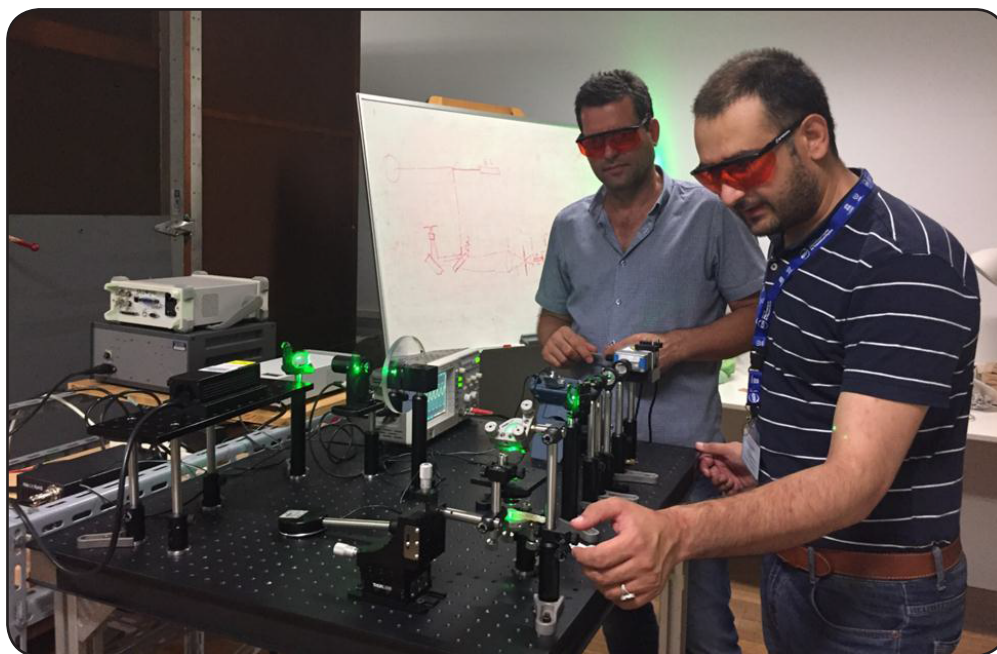


**Photo 3. Optics and OEA:** Prof Jehan Akbar from Hazara University, located in the northwest Khyber Pakhtunkhwa region of Pakistan, on a TRIL Fellowship to the Optics Lab. Jehan was also a recipient of the ICO-ICTP Gallieno Denardo Prize and was a past Associate of ICTP. During his 3-month research visit, he also worked with Humberto (shown in the background) to write a successful grant to the Pakistani regional government, establishing the first ever research laboratory at his institution. His home laboratory replicated many elements of the ICTP lab, especially aiming at its high ratio of scientific production to capital equipment cost.

In summary, Gallieno had a personal passion and vision for the development of optical sciences in less advantaged countries. Together with others who have followed, he benefitted greatly by coordinating different programs being managed through the Office of External Activities. The programs complemented and enhanced the advanced educational training offered by the Winter Colleges on Optics, which certainly brought him the greatest personal joy. The opportunity to holistically boost the development of science, and especially the development of scientists, in developing countries through the OEA was an important factor in his success. He would have had a positive impact even without the OEA, of course, but Gallieno used it to full advantage to meet some central goals of ICTP, as anyone who knew him would have expected.

*Epilogue:*

Gallieno Denardo was a professor at the University of Trieste who eventually served a wider world through ICTP, representing two UN specialized agencies: The International Atomic Energy Agency (IAEA) and the United Nations Educational, Scientific and Cultural Organization (UNESCO) of which he was a member of its professional scientific staff. Abdus Salam – who had a wide vision for ICTP’s role in global education and advanced training and who was politically savvy – understood the mutual benefits of this connection. ICTP has consistently made efforts to enhance it, informing policy with scientific thought, and in turn leveraging UNESCO’s convening power to better implement on-the-ground programmes for the benefit of scientists in all parts of the world. We close with one additional figure that reflects the authors’ personal efforts in this regard and with relevance to what we have discussed here.



**Photo 4.** Optics and OEA: Engagement with UNESCO. Left: One of us (Joseph J Niemela) speaking at UNESCO during the Opening Ceremony of the UNESCO International Day of Light (see text) gathering in Paris many leaders in optics and photonics, including a number of the authors represented in this volume. Right: The other (Katepalli R Sreenivasan) hosting the Director-General of UNESCO Kōichirō Matsuura (shown on left) at ICTP on the occasion of the ICTP Prize Ceremony. The prize recognizes young scientists from developing countries who work and live in those countries and who have made outstanding and original contributions to physics. The two photos illustrate the authors’ commitment to strengthening the engagement between the international scientific community and UNESCO.