Future Challenges of Physics
New opportunities for cooperation in science between
Italy and Serbia

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Institute of Physics Belgrade, the first National Institute of Serbia, and INFN, Italy's National Institute for Nuclear Physics, have since 2013 implemented a process of partnership built on collaboration in High Energy Physics, both directly as well as through CERN.

IPB is honored to have Fernando Ferroni (former president of INFN) as a member of its International Advisory Board, playing a key advisory role in inplementing two of our strategic projects: construction of Verrocchio Center at IPB (financed by the Government of Serbia), and strengthening of IPB through the SAIGE project (financed by EU and World Bank). We hope that we will soon have further opportunities to collaborate with Nando – this time at the Einstein observatory in Sardinia.

We have also substantially benefited from the help of Antonio Zoccoli the current INFN president: in his primary field of supercomputing, in the key role he has played in a series of meetings aiming to strengthen collaboration between Serbia and Italy in research as well as in business, and most notably through his help in the effort to establish Verrocchio Center at IPB. Staying with the Verrocchio theme, a delegation from IPB recently visited Florence the home of the original Verrocchio. Among other institutions, we visited INFN's Cultural Heritage Network identifying many fertile areas for future collaboration.

As these few examples show, for IPB the partnership with INFN is a strategic one covering joint collaborations in basic and applied research, technology transfer, two-way researcher mobility and exchange of administrative and organizational expertise. For IPB this

is a long-term partnership that unfolds in parallel with growing business and cultural partnerships between our two countries.

HIGH ENERGY PHYSICS

As I already mentioned, everything started with our common research interests in the realm of elementary particles – in High Energy Physics (both experiment and theory) as well as in supercomputing. We hope to widen this to the fields of related technological cooperation. One of the key milestones already passed has been Serbia's membership in CERN.

One of the beautiful dualities in physics is the one linking the worlds of the very small (High Energy Physics) and the very large (Cosmology). The Standard Model in one field is the key building block of the Standard Model in the other. Cracks, inconsistencies, and new information in one often leads to new insight in the other. For a long time, the microworld has led this game – the result of decades of successes in which we have "resolved" objects that are as small compared to atoms as atoms are small compared to us. It may be time to turn to experimentally analyzing the world at its largest scales, and in doing so gathering new intuition not only about the Universe as a whole, but also about its fundamental laws operating at the smallest scales.

It is not a matter of choosing between the best microscopes and the best telescopes. We need both, we choose both. The best microscope today is CERN's LHC, the best telescope (in some sense) will appropriately be named EINSTEN. In a time when Europe no longer leads or inspires the world (and itself) in almost anything, physics research offers an important exception to this rule – an exception pointing to a role for our continent that is not just relevant to the past but also for the future.

EINSTEIN

Only a short number of years have passed since the first two generations of gravitational wave telescopes have opened our “eyes” not to different wavelengths of light, but rather to completely different carriers of information – to waves of deformations of space-time itself (also propagating at the speed of light) first theoretically predicted by Albert Einstein in his General Theory of Relativity.

Successes of technological marvels such as VIRGO in Italy and the two LIGO telescopes in the US have offered proof of the amazing scientific potential inherent in gravity wave astronomy. In addition to sight, we now have a completely new sense with which to observe the universe, a sense akin to touch. There is much to be excited about – imagine how your first kiss or caress changed your conception of the world.

Technological evolution is extremely rapid. The next generation is upon us – the Einstein Telescope (hopefully in Sardinia) – the third generation gravitational wave observatory made up of a triangular laser interferometer (10 km to a side) several hundred meters underground. With extreme sensitivity to low frequencies Einstein will usher in the era of precision gravitational astronomy.

IPB is interested in collaborating with INFN from the very beginning of the EINSTEIN project. This is precisely the ambitious, long-range process that can be used to substantially increase the scientific and technological capacities of IPB and other Serbian institutions. We will do our utmost to lobby our government to participate in this process. We hope we can be as successful in meeting this milestone as we have been in becoming members of CERN. We believe that we owe this to our famous compatriots: Tesla, Pupin and Milankovic, we owe it to Serbia’s coming generation of researchers and engineers that rightly seek to be inspired and motivated.