

# Newsletter Interview

## COSMOLOGY WITH GRAVITATIONAL WAVES: GRAVITYSIRENS WINS AN ERC STARTING GRANT



*Interview with Simone Mastrogiovanni, researcher at the INFN Roma Division, and member of the Virgo and Einstein Telescope collaborations*

The European Research Council recently awarded a Starting Grant worth 1.5 million euros to the GravitySirens project, which aims to measure the expansion of the universe using gravitational wave signals produced by the coalescence of binary systems of black holes and neutron stars. Proposing the project was Simone Mastrogiovanni, a researcher at the INFN Rome

division and a member of the Virgo and Einstein Telescope collaborations. GravitySirens is a project that lies between experimental and theoretical physics, and could have an important impact on our understanding of the universe. We asked Simone Mastrogiovanni to tell us about his goals and expectations for developing the project he has created.

**Could you give us an overview of what GravitySirens is and what its premises are? In your opinion, why was the project selected by the ERC?**

The goal of GravitySirens is to study the mechanisms that drive cosmological expansion, using gravitational wave sources. But not only that, GravitySirens will also focus on discovering how binary systems of compact objects, such as black holes or neutron stars, evolve on cosmological scales and relate to the astrophysical environments that host them. This aspect of the project is also critical to understanding how the most compact objects we know of are formed.

I think the most innovative aspect of my project is the study of cosmological expansion with a multidisciplinary approach, starting with gravitational waves and the LIGO, Virgo and KAGRA detectors and combining observations from

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eneration radio telescopes. In addition, m for about nine years and only recently we ce that at the end of my project, gravitational measurements are inconsistent between direct

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**nt? What were the main difficulties for you in**

Definitely the biggest difficulty I encountered was convincing myself that my project could be funded by the ERC and that therefore it was a good idea to spend three months of my time on writing the project. The academic environment is highly competitive, and often this job requires duties that go beyond scientific research. Time is therefore a very valuable resource. I make no secret that writing the project and preparing for the oral were also difficult. You are supposed to communicate clearly and directly what the innovations, risks and potentials are in your research field. This requires an effort, both in communication and scientific terms, but I think it is worthwhile even if you do not get the grant. During my preparation, I was forced to review some of the strategies I had previously developed, expand my knowledge, and also seek experience from colleagues in the field. This also expanded my collaboration network, which is essential in research.

### **How will you use the grant obtained? What challenges do you expect to have to face over the five years of the project?**

GravitySirens is a multidisciplinary project, much of the budget will be spent on hiring scientists who are experts in the fields necessary for the project. Over the next few years, I will hire researchers with expertise in black hole astrophysics and galaxy observations, who will provide knowledge and experience complementary to my own. I will also fund three PhD grants for physics and astrophysics students, because I believe that training young people in this nascent field is also an investment in our future. Finally, I will purchase computers with which we will analyse the huge amount of data coming in over the next few years.

The biggest difficulty I foresee is that we will be dealing with very different data sets, which we will describe with different physics and will have to interrelate with them through models that we do not yet know. All this in order to study cosmological expansion. GravitySirens will definitely require its participants to go outside their comfort zone, and this sometimes does not facilitate achievement of the result. However, as I said earlier, I also consider this to be one of the main innovations of the project.

### **At a personal level, what does it mean for you to have received this grant?**

From a scientific point of view, it makes me proud to think that some of the most experienced scientists in the field have become convinced that my vision can actually lead to an advancement of our knowledge in the gravitational wave field. I feel truly honoured by this.

From a personal point of view, it is definitely a recognition of almost 14 years of study, with failures, successes and sacrifices, both personal and of people close to me. It is also the fruit of interactions with colleagues who have shared joys and difficulties with me from various parts of the world. I am very pleased that the European Research

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researchers to whom I can pass on an inclusive  
physics from the Universities of Rome Sapienza  
ory of Astroparticles and Cosmology of the  
ervatoire de la Côte d'Azur in Nice. Today he is a  
es on the study of the universe, particularly its  
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