Ulyana Dupletsa | Curriculum Vitae et Studiorum
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Personal Information

Name: Ulyana Dupletsa
Date of Birth: 1st January 1994
Citizenship: Italian, Ukrainian
Actual position: graduate student at the University of Milan-Bicocca
Personal webpage: `ulyanadupletsa.github.io`

Education

- **University of Milan-Bicocca**
  Master's degree in Theoretical Physics, Milan — *2017–2019*
  - *Final degree grade*: $110/110$ cum laude
  - *Average class grade*: $29.8/30$
  - *Thesis advisor*: Alberto Zaffaroni
  - *Thesis title*: 'Thermodynamic Aspects of AdS_4 Black Holes in $N = 2$ Gauged Supergravity'

- **University of Milan-Bicocca**
  Bachelor's degree in Physics, Milan — *2013–2017*
  - *Final degree grade*: $110/110$ cum laude
  - *Average class grade*: $29/30$
  - *Thesis advisor*: Monica Colpi
  - *Thesis title*: 'Supermassive Binary Black Holes and their Dynamics in Galactic Nuclei'

Research Activity

Post Master Research Project
From February 2020, I am working, in collaboration with professor Alberto Sesana of the Bicocca University, on implementing time delays on supermassive black holes binaries. Using the data drawn from the catalogues of the Millennium Simulation, which assumes black holes at the centres of respective galaxies merge as soon as the galaxies merge, black hole dynamics is studied for each galactic merger. We study black hole merger trees, analyzing the merger history of supermassive black holes that are present at redshift zero according to the simulation. In particular, we take into account time delays due to dynamical friction, stellar/gaseous hardening and then coalescence via emission of gravitational waves. Considering delays for binary mergers can result in black hole binary systems that are not able to coalesce before the subsequent galactic merger, thus leading to triplet systems. Triplet systems are in turn analyzed taking into consideration the possibility of a prompt merger triggered by the intruder black hole or the ejection of one of the three black holes. The implementation of time delays and triplet interactions affects the supermassive black hole merger rates as well as the characteristic gravitational wave background strain.

Supermassive black hole coalescences are powerful sources of gravitational waves in the low frequency band. Studying their dynamics and evolution is of crucial importance for understanding how supermassive black holes form in the context of the hierarchical assembly of cosmic structures.

Master's thesis
The project analyzes thermodynamic properties of a class of static magnetically charged AdS_4 black holes resulting as solutions of $N = 2$ Fayet-Iliopoulos gauged supergravity theory, coupled with running scalars. Particular focus is devoted in investigating the relation between the on-shell gravitational action and the entropy for a class of AdS black holes, which states that the on-shell gravitational action, when evaluated at its BPS limit, equals minus the black hole entropy, calculated as the area of the event horizon. It should hold for consistency, when considering the thermodynamic relation between the black hole entropy and the dual field theory partition function, on one side, and the holographic correspondence between the dual field theory partition function and the on-shell gravitational action, on the other. We find that its validity depends on the choice of boundary conditions for the scalar fields.

Bachelor's thesis
The project deals with the analysis of the coalescence time of supermassive black hole binaries. The aim is to investigate whether such systems are able to coalesce in less than the Hubble time. If so, they would become a promising source of gravitational waves for space based gravitational detectors, as LISA. The results vary according to the binary mass ratio and to the type and the density profile of the hosting galaxy, giving an overall range between 0.1 to some tens of Gyrs.

Minor Computational Projects
These are two programs written in C that implement Markov Chain algorithms to solve problems in physics which I developed as part of the Computational Physics course

- A numerical resolution for the simple harmonic oscillator energy for the calculation of the energy gap between the fundamental and the first level
  (`https://github.com/ulyanadupletsa/HarmonicOscillator`)
- Analysis of observables dependent on magnetization for a scalar field theory on lattice with quartic interaction. A Hamiltonian approach in Monte Carlo methods is used
  (`https://github.com/ulyanadupletsa/LatticePhi4Theory`)

Skills

Programming languages: C/C++, Python, Bash, Mathematica, Matlab
Other scientific tools: LaTex
Languages: Italian (mother tongue), Ukrainian (mother tongue), English (fluent, in possession of TOEFL certificate, with a result of 104/120 taken on 20th December 2019)