



We celebrate the 40th edition of the *École Joliot-Curie* with a very topical and multidisciplinary subject, “*Nuclear Matter under Pressure*”. The general concept of pressure in nuclear matter will be used as a connecting thread between very different scales, from the nucleon to compact stars, providing a complete view of the phase diagram of dense matter.

Starting from the **nucleon**, high-energy exclusive experiments some 20 years ago are able to probe its content in energy, angular momentum and pressure. These properties are encoded in the so-called energy-momentum tensor, which plays the role of source for gravitation in General Relativity. In 2018, the first experimental extraction of the pressure distribution inside the nucleon indicated that the central value can be about 10 times larger than in neutron stars. Moreover, relativistic effects make the pressure highly anisotropic. In the coming years, a new electron-ion collider will start collecting data of unprecedented quality and will offer a much deeper understanding of the nucleon structure, providing answers to fundamental questions about the origin of the nucleon mass, angular momentum and stability.

Inside the **nucleus**, a large number of those nucleons can join to induce high-frequency collective excitation modes, or giant resonances, which are linked to the nuclear equation of state. In particular, the compression modes are related to the nuclear incompressibility, and the recent extension of their study to neutron-rich nuclei is improving our understanding of neutron matter under pressure. Moreover, the collision of those nuclei in the Fermi energy range can probe transport properties and the nuclear equation of state at finite temperature. The generalization of these experiments over a broad range of nuclear systems, in terms of incident energy and size, is providing information that is indeed crucial in the astrophysical context of compact stars.

At this **stellar** end of the scale, the first direct detection by the LIGO-Virgo collaboration of gravitational waves emitted by coalescing black holes in 2015 opened a new window to the Universe. The detection in 2017 of the first gravitational-wave signal from the coalescence of two neutron stars, followed by the observations of signals from the synthesis of new elements, marked the birth of multi-messenger astronomy. The X-ray observations of isolated pulsars by the NICER instrument has also recently shed new light on the structure of neutron stars. Beyond the astrophysical aspects, all these observations also provide valuable information on the properties of nuclear matter at very high densities, which are complementary to those obtained in the laboratory by the study of atomic nuclei, nucleons and heavy-ion collisions.

This school will allow students to acquire and/or consolidate their knowledge on the properties of dense matter probed in nuclear physics experiments as well as through astrophysical observations, in a research field at the interface between hadro-nuclear physics and astrophysics. They will have the opportunity to open up to different subjects and to exchange with actors from various horizons, which will be all the more enriching.



This special edition will take place from September 4 to 9 at *La Vieille Perrotine*, a CNRS resort located on the Oléron island along the French Atlantic coast, accessible from the TGV train station of La Rochelle and the airports of La Rochelle and Bordeaux:

<https://www.caes.cnrs.fr/sejours/la-vieille-perrotine/>

Participants are expected to arrive on the afternoon of Sunday 4 and leave on Friday 9 after lunch. **Pre-registration is open from April 1 to May 15.** Details on the registration procedure, and the school in general, can be found at:

<https://ejc2022.sciencesconf.org/>

Acceptance will be communicated by e-mail before June 1, along with the procedure to follow for the final registration and payment.

On behalf of the Organizing Committee: Nicolas Chamel, Aurélie Gontier (secretary), Elias Khan, Cédric Lorcé, Jérôme Margueron, Miguel Marqués (chair), Soizic Milhoud (communication), Carlos Muñoz Camacho.

PS/ List of speakers and lectures (more details to come on the website):

- Nicole d'Hose (CEA-Saclay, France):  
*"From high-energy lepton scattering to nucleon pressure"*
- Bruno Giacomazzo (Univ. of Milano-Bicocca, Italy):  
*"Binary Neutron Star Mergers and Nuclear Physics"*
- Julien Gibelin (LPC, France):  
*"Giant resonance properties and the nuclear equation of state"*
- Olivier Lopez (LPC, France):  
*"From transport properties to the nuclear equation of state: an experimental survey in the Fermi energy range"*
- Hervé Moutarde (CEA-Saclay, France):  
*"Exclusive reactions as a nuclear manometer"*
- Xavier Roca-Maza (Univ. of Milano, Italy):  
*"Nuclear equation of state from ground and excited state properties of nuclei"*
- Anna Watts (Univ. of Amsterdam, Netherlands):  
*"Neutron star observations and extreme matter properties"*