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Gravitational waves from hot neutron stars and how to find out more about matter under extreme conditions with them

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Typical neutron stars have a mass of the order of a solar mass and a radius of about 10 km, making them the most compact objects in our universe. However, the extreme conditions inside a neutron star, i.e., an extremely high density, cannot be reproduced on Earth. Therefore, the equation of state describing extremely compact nuclear matter is still largely unknown. Due to their small size and the fact that they emit almost no significant electromagnetic radiation, neutron stars are very difficult to observe. Since their first detection in August 2017, it is now possible to study them with the help of gravitational waves, which have been emitted millions of years ago during the merger of two inspiraling neutron stars. This was the first event ever that was detected both in the electromagnetic and the gravitational wave spectrum, heralding the beginning of the so-called multimessenger astronomy. My own research focuses on oscillations of hot, massive neutron stars that are possible remnants of a binary neutron star merger. During the violent formation, certain oscillation modes are excited and emit copious amounts of gravitational waves which, if detected, will provide valuable information about the stellar composition.

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