

Description for the general public

The main goal of our project is to understand the nature of neutron stars, that are the end products of the stellar evolution. Neutron stars are the objects with a mass of about 1.5 Solar masses, while their diameter is only of 20 kilometres. In addition, these stars have very strong magnetic fields and they rotate very fast, in extreme cases even with a rotation period of a few milliseconds. Therefore, these stars are unique laboratories to study relativistic effects. In our study we focus on the optical polarimetric properties of the radiation of particular type of neutron stars, i.e. pulsars.

Pulsars are mainly discovered in the radio band of the electromagnetic spectrum using radio telescopes. Some of them are also observed in other spectral ranges: optical, X-ray or gamma. In the case of optical range, the biggest problem with pulsar detection is their very low brightness which makes the detection difficult. Currently, only a few optical pulsars are known, however only for one, i.e. the Crab pulsar, the optical polarization details are known. Our main goal is to measure the polarization of two other optical pulsars, Geminga and B0656+14. We are going to achieve our goals by using the POLISH2 optical polarimeter, that is going to be mounted on the 8-meter Gemini North telescope on Hawaii, as well as on the 3-m telescope at the Lick Observatory in California. In addition, we will also investigate the properties of polarized radiation of binary system which includes a millisecond pulsar and a low-mass stellar companion. Our research will help to understand the physical processes responsible for the radiation of these exotic objects.