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Nuclei of greatest impact on the composition of neutron-star outer crusts

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Neutron stars are the cold, dead remnants of the gravitational collapse of massive stars that ended their lives in violent supernova explosions. With a mass around 1.5{2 times the mass of our Sun packed within a typical radius of about 10 km, neutron stars are among the most compact objects in the universe. This makes neutron stars unique natural laboratories for testing the physical theories of dense matter.
In this work we study the outer crust of cold, nonaccreting neutron stars, and more specically the nuclear composition of the outer crust. We intend to probe the sensitivity of the crustal composition to the nuclear masses that are not experimentally available and need to be predicted using nuclear models. Mapping the composition of the outer crust is strongly dependent on neutron-rich nuclides with atomic numbers Z 20 ☒ 50 near the N = 50 and N = 82 neutron shell closures. However, the actual value of the proton and neutron numbers of the nuclides that populate the bottom layers of the outer crust is something that until today remains elusive. It is due to the fact that such an information is contingent on the masses of exotic neutron-rich isotopes that are not yet measured. The present study aims to elucidate the nuclear species that have the greatest in
uence on the composition
of a neutron-star crust after the last nuclides with known masses, and to identify at the same time the most critical new masses to be measured. The results of this type of studies may have practical signicance for both nuclear and astrophysical research.
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