Octupole Deformation in ^{220,222,224,226}Rn

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A large amount of evidence suggests that octupole deformation exists in nuclei, corresponding to a pear-shaped nucleus. ^{220,222,224,226}Rn are among the important candidates for observing octupole deformation in nuclei. We studied these nuclei using multidimensionally constrained relativistic mean field model. We calculated the ground state binding energies, nuclear isomers, quadrupole deformation parameters, and octupole deformation parameters of these nuclei, and we also obtained the potential energy surfaces. The calculated results indicate that the ground state of ^{220,226}Rn has no octupole deformation, while the ground states of ^{222,224}Rn exhibit octupole deformation. Besides, we studied the relationship between pairing correlation and octupole deformation, and found that the neutron pairing energy decreases as the octupole deformation increases, while the proton pairing energy exhibits the opposite behavior. We also examined the single-particle energy levels near the Fermi surface and explained the microscopic origin of octupole deformation in these radon isotopes. Experiment has shown that these radon isotopes undergo octupole vibrations but the octupole deformation remains to be observed further.