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Impact of strange quark matter nuggets on pycnonuclear reaction rates in the crusts of neutron stars¹ FRIDOLIN WEBER, BARBARA GOLF, JOE HELLMERS, San Diego State University — This paper presents an investigation into the pycnonuclear reaction rates in dense crustal matter of neutron stars contaminated with strange quark matter nuggets. The presence of such nuggets in the crustal matter of neutron stars would be a natural consequence if Witten's strange quark matter hypothesis is correct. The methodology presented in this paper is a recreation of a recent representation of nuclear force interactions embedded within pycnonuclear reaction processes. The study then extends the methodology to incorporate distinctive theoretical characteristics of strange quark matter nuggets, like their low charge-per-baryon ratio, and then assesses their effects on the pycnonuclear reaction rates. Particular emphasis is put on the impact of color superconductivity on the reaction rates. Depending on whether or not quark nuggets are in this novel state of matter, their electric charge properties vary drastically which turns out to have a dramatic effect on the pycnonuclear reaction rates. Future nuclear fusion network calculations may thus have the potential to shed light on the existence of strange quark matter nuggets and on whether or not they are in a color superconducting state, as suggested by QCD.

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