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The KAMEO proposal: investigating the strong kaon-nucleus interaction through the E2 nuclear resosnance effect in kaonic atoms

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Kaonic atoms are atomic systems in which a negatively charged kaon is captured in the atomic shell, replacing an electron. The capture occurs at a highly excited atomic level, then the kaon starts an electromagnetic cascade to the innermost atomic levels, where the strong kaon-nucleus interaction becomes detectable with X-ray spectroscopy. Kaonic atoms allow the study of strong interaction in the strangeness sector, at low energies. The E2 nuclear resonance occurs when atomic de-excitation energy is closely matched by nuclear excitation energy. It mixes the atomic and nuclear states due to the electrical quadrupole excitation of the nucleus. In the specific, the mixing occurs among $(n, l, 0^+)$ and $(n', l-2, 2^+)$ states. As a consequence, the E2 nuclear resonance produces an attenuation of some of the atomic x-ray lines from resonant versus normal isotope target and, in kaonic atoms, it allows the negatively charged kaon to reach inner levels of the atom not easily accessible through the electromagnetic cascade, because of the nuclear absorption. The investigation of the nuclear E2 resonance effect in kaonic ticklish atoms could provide important information about strong kaon nucleus interaction. The E2 nuclear resonance effect is expected to occur in four kaonic Molybdenum isotopes ($^{94}_{42}$Mo, $^{96}_{42}$Mo, $^{98}_{42}$Mo, and $^{100}_{42}$Mo) with similar energy values. The KAMEO (Kaonic Atoms Measuring Nuclear Resonance Effects Observables) proposal plans to measure this effect in kaonic Mo isotopes at the DAΦNE e^+e^- collider, in Frascati (LNF-INFN). The KAMEO apparatus will equip four solid strip targets of enriched Mo isotope each, exposed to negatively charged kaons produced by DAΦNE. A high-purity germanium detector, placed just behind the target strips, will be used for the x-ray spectroscopy. An additional solid strip target of non-resonant $^{92}_{42}$Mo isotope will be exposed to be used as a reference for standard non-resonant transitions. This experiment would provide a conclusive measurement of the E2 nuclear resonance effects in 4 isotopes of kaonic molybdenum, investigating strong kaon-nucleus properties, at low energies, in heavy kaonic atoms.

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