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Nuclear Structure of ^{36}Al and ^{36}Si via β-decays of ^{36}Mg and ^{36}Al

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The β-decays of ^{36}Mg and ^{36}Al have been studied at The National Superconducting Cyclotron Laboratory (NSCL) in order to extract the half-lives of the parent nuclei and reveal the nuclear structure of the decaying descendants. Neutron-rich ^{36}Mg and ^{36}Al were produced at the NSCL's Coupled Cyclotron Facility via projectile fragmentation of a ^{48}Ca beam of energy 140 MeV/u impinged on a 642 mg/cm^2 thick ^{9}Be target. The fragmented beam was delivered to the decay station after being resolved by the A1900 separator. Two Si p-i-n detectors were used for the particle identification whereas the ions were implanted on a 3-mm thick $CeBr_3$ scintilator coupled to a position-sensitive photo multiplier tube (PSPMT). The β-delayed γ-rays were identified with 16 segmented Ge detector array (SeGA) and 15 $LaBr_3$ detectors. The half-lives of the two parent nuclei were determined and were compared to the previous measurements. β-delayed γ-ray transitions were observed in ^{36}Al and ^{36}Si for the first time and their level schemes were built from the correlated β decays of ^{36}Mg and ^{36}Al. Excited energy states of ^{36}Al populated by the β-decay of ^{36}Mg are proposed, whereas only the ground state information was available prior to this work. The experimental results were interpreted by using the nuclear configuration interaction studies with the FSU shell-model Hamiltonian. The results will shed light on our understanding of the structure of more exotic neutron-rich nuclei to be produced with the FRIB.

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