TRIUMF Advanced Rare Isotope Laboratory (ARIEL)

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# The BeEST experiment in the ARIEL era

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Precision measurements of the final-state products in nuclear beta decay and electron capture (EC) decay processes can be used as powerful laboratories to search for beyond standard model (BSM) physics from the meV to TeV scale, as well as for targeting fundamental questions of quantum mechanics at the subatomic scale. For the past seven years, the BeEST (Beryllium Electron capture in Superconducting Tunnel Junctions (STJs)) collaboration has taken the approach of embedding electron-capture (EC) decaying radioisotopes produced at TRIUMF in thin-film STJs to precisely measure the recoiling atom that gets an eV-scale "kick" from the neutrino following EC decay. Since these recoils must conserve energy and momentum with the neutrino, they carry unique (and potentially "hidden") signatures of weakly coupled BSM physics. As such, nuclear recoil spectroscopy of EC decaying isotopes has shown tremendous promise in our search for signatures of BSM physics including neutrino mass, exotic weak currents, and potential "dark"particles created within the Q-value window of the decay; including neutrino mass, exotic weak currents, and potential "dark" particles created within the □-value window of the decay. Such measurements provide a complimentary and (crucially) model-independent portal to the dark sector with sensitivities that push towards synergy between laboratory and cosmological probes.
I will introduce the experimental concept and extensions of the research program before discussing prospects for the experimental program in the ARIEL era.

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