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Long-Lived Particles from Meson and Muon Decays at Rest at Spallation Sources

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We provide a systematic survey of spallation sources around the world and their potential to search for new light particles. We study the sensitivity of existing neutrino detectors to the decay in flight of light particles produced in the decay at rest of pions, muons, and kaons. At J-PARC, we show that the magnetized gaseous argon detectors of ND280 could place leading limits on light particles decaying to e^+e^- and that the liquid-scintillator detectors of the J-PARC Sterile Neutrino Search at the JSNS (JSNS²) experiment can exploit double- and triple-coincidence signals from $\mu^+\mu^-$ and $\pi^+\pi^-$ to place new limits on particles produced in kaon decay. We find that the Coherent Captain Mills detector at Los Alamos and the suite of COHERENT detectors at Oak Ridge, despite their smaller size, would also have a promising sensitivity to particles produced in pion and muon decays, depending on background levels. Spallation sources have the potential to explore more than an order of magnitude beyond current constraints in some new physics models, encouraging further study on data acquisition and background rejection by experimental collaborations.

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Classification de Session: Neutrinos