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Spectrometers for Beta Decay Electrons YONG JIANG, JAY HIRSHFIELD, Yale University — Inspired by the neutrino mass direct measurement experiment Project 8, precision spectrometers are proposed to simultaneously measure energy and momentum of beta-decay electrons produced in rare nuclear events with improved energy resolution. For detecting single beta decay electrons near the end-point from a gaseous source such as tritium, one type of spectrometer is proposed to utilize stimulated cyclotron resonance interaction of microwaves with electrons in a waveguide immersed in a magnetic mirror. In the external RF fields, on-resonance electrons will satisfy both the cyclotron resonance condition and waveguide dispersion relationship. By correlating the resonances at two waveguide modes, one can associate the frequencies with both the energy and longitudinal momentum of an on-resonance electron to account for the Doppler shifts. For detecting neutrino-less double-beta decay, another spectrometer is proposed with thin foil of double-beta-allowed material immersed in a magnetic field, and RF antenna array for detection of synchrotron radiation from electrons. It utilizes the correlation between the antenna signals including higher harmonics of radiation to reconstruct the total energy distribution.

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