

Extensions of the ‘paleoSens’/‘paleoSpec’ Codes

Friday, April 17, 2026 11:30 AM (30 minutes)

The Python packages paleoSens and paleoSpec, developed by Baum *et al.*, are widely used to forecast the sensitivity of paleo-detectors. In the standard framework, paleoSpec computes recoil-energy spectra for signal and backgrounds and converts them into track-length histograms, while paleoSens derives projected sensitivities from the resulting signal and background histograms through a statistical analysis.

This treatment assumes an ideal readout in which track lengths are directly measurable. However, this is not always the case. In DMICA (after Snowden-Ifft *et al.*, 1994), recoils intersecting the mica cleavage plane are read out by chemical etching and appear as nanometer-scale etch pits. The relevant observable is therefore the pit-depth histogram rather than the track-length distribution. We have extended paleoSpec to compute pit-depth spectra for both signal and backgrounds.

In this talk, I present two further extensions:

- paleoSens: a module that evaluates the overburden-limited upper reach in cross section, i.e. the maximum cross section for which particles can still reach the sample with sufficient energy after attenuation in the overburden.

- paleoSpec: a module that computes pit-depth histograms from the double-differential recoil spectrum

$$d^2 R \frac{dE}{d\mu} \frac{d\mu}{\mu \equiv \cos \theta}$$

enabling forecasts for anisotropic scenarios such as the dark-matter wind, the cosmic-wall scenario (arXiv : 2505.15764), and neutron-irradiation calibration experiments, where the pit-depth spectrum depends on the angle between the

These extensions broaden the applicability of paleoSens/paleoSpec to alternative readout observables and to physics cases in which directionality must be taken into account.

Do you plan to give the talk in person?

Yes

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