Dark Matter & Neutrinos under the Microscope

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Despite the recent advances in physics, Dark Matter (DM) still eludes detection by modern large-scale experiments and puzzles the minds of physicists. Paleo-detectors represent a drastically different approach to DM detection. We propose to take advantage of the advent of modern microscopy and computational techniques to read out and analyze nanometer-sized damage features produced by interactions of DM particles and neutrinos with nuclei of ancient minerals. Over millions of years spent in the depths of the Earth certain minerals should have accumulated these minute structures, allowing us to use them as “paleo-detectors”. Despite their small size the Gyr-scale lifetime of paleo-detectors provides them with enormous exposure, allowing them to probe DM-nucleon cross sections below current best upper limits over a range of DM masses. Uniquely, such detectors can also probe the distribution of DM in our Galaxy and the evolution of neutrino fluxes over our Galaxy's lifetime. In this talk, I will report on the latest research and developments towards the use of mineral-based paleo-detectors.