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Radio-impurity studies for dark matter detection with the SABRE South experiment

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The aim of the SABRE (Sodium-iodide with Active Background REjection) experiment is to detect an annual rate modulation from dark matter interactions in ultra-high purity NaI(Tl) crystals in order to provide a model independent test of the signal observed by DAMA/LIBRA. The scientific program includes the deployment of two separate detectors: SABRE South located at the Stawell Undergrond Physics Laboratory (SUPL) in Australia and SABRE North at the Laboratori Nazionali del Gran Sasso (LNGS) in Italy.

Ultra-high purity of the NaI(Tl) crystals are a crucial feature of the SABRE South detector. Radiation from both intrinsic and cosmogenic processes in the detector material must be studied and quantified in order to distinguish it from dark matter events. NaI(Tl) crystals are immersed in a liquid scintillator veto, further surrounded by passive steel and polyethylene shielding and a plastic scintillator muon veto. Furthermore, the SABRE collaboration develops ultra-sensitive techniques to measure radionuclides that could mimic dark matter events. Currently the focus is being put on radionuclides potassium-40 and lead-210, which are expected to be the dominant radio-impurities in the crystal background. Chemical procedures, sample preparation as well as sample measurements via accelerator mass spectrometry and inductively coupled plasma mass spectrometry are under development in order to understand the sensitivity of SABRE South.

In this talk the current status of the radioimpurity-studies and their importance for the SABRE South experiment are conferred. The chemical methods, sample preparation as well as measurement techniques under investigation to be used to quantify the radio-impurities in the NaI(Tl) crystals are addressed.

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