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Development of high-resolution InSb detectors at USD for DM search

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We have been successfully growing HPGe single crystals for a decade here at University of South Dakota by using the Czochralski method. These HPGe detector-grade single crystals are fabricated into radiation detectors used in many research and application areas such as rare event physics. However, new semiconductor is still necessary especially in high resolution X-rays and gamma rays spectroscopy. The most promising candidate material is Indium Antimonide (InSb), a binary semiconductor which may be developed as a future ultra-high-resolution radiation detector due to its very small band gap of 0.165 eV and its large electron mobility of around 78000 $cm^2V^{-1}s^{-1}$. This small band gap could provide even better resolution and a higher peak-to-Compton ratios than Ge does.
Most of the previous works on the InSb crystals were concentrated on infrared applications. At this work, we present some theoretical calculations of InSb detectors compared to our own HPGe radiation detectors. And also, we present the experimental set up to grow the single crystals of InSb by Czochralski method in our lab.

Primary author: RAUT, Mathbar Singh (University of South Dakota)

Presenter: RAUT, Mathbar Singh (University of South Dakota)

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