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Recent advancements on the spherical proportional counter instrumentation for NEWS-G

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NEWS-G (New Experiments With Spheres-Gas) is an innovative experiment aiming to shine a light on the dark matter conundrum with a novel gaseous detector, the spherical proportional counter. It uses light gases, such as hydrogen, helium, and neon, as targets, to expand dark matter searches to the 0.05 - 10 GeV/c² mass region. NEWS-G produced its first results with a detector -60 cm in diameter- installed at LSM (France), excluding cross-sections above 4.4 10³⁷ cm² for 0.5 GeV/c² WIMP using neon gas. Currently, a larger detector -140 cm in diameter- is being installed at SNOLAB (Canada) and the commissioning is expected to commence in March 2021, before operation later this year. In this talk, I present developments incorporated in this new detector: a) sensor technologies using resistive materials and multi-anode read-out that allow high gain - high-pressure operation, b) gas purification techniques to remove contaminants (H₂O, O₂) and radon impurities, c) reduction of ²¹⁰Pb induced background through copper electroforming methods, d) utilisation of UV-lasers for detector calibration, detector response monitoring and estimation of gas-related fundamental properties, e) field correction electrodes to achieve a homogenous response from the whole detector volume. This next experimental phase of NEWS-G will allow searches for low mass dark matter with unprecedented sensitivity. Finally, ideas on future R&D for spherical proportional counter sensor instrumentation, aiming at high-pressure operation in larger volumes are outlined.

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