

A Micromegas-based low-background x-ray detector coupled to a slumped-glass telescope for axion research - DTU Orbit (08/11/2017)

A Micromegas-based low-background x-ray detector coupled to a slumped-glass telescope for axion research

We report on the design, construction and operation of a low background x-ray detection line composed of a shielded Micromegas detector of the microbulk technology. The detector is made from radiopure materials and is placed at the focal point of a ~ 5 cm diameter, 1.5 m focal-length, cone-approximation Wolter I x-ray telescope (XRT) assembled from thermally-formed (or "slumped") glass substrates deposited with multilayer coatings. The system has been conceived as a technological pathfinder for the future International Axion Observatory (IAXO), as it combines two of the techniques (optic and detector) proposed in the conceptual design of the project. It is innovative for two reasons: it is the first time an x-ray optic has been designed and fabricated specifically for axion research, and the first time a Micromegas detector has been operated with an x-ray optic. The line has been installed at one end of the CERN Axion Solar Telescope (CAST) magnet and is currently looking for solar axions. The combination of the XRT and Micromegas detector provides the best signal-to-noise ratio obtained so far by any detection system of the CAST experiment with a background rate of 5.4×10^{-3} counts per hour in the energy region-of-interest and signal spot area.

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Authors: Aznar, F. (Ekstern), Castel, J. (Ekstern), Christensen, F. E. (Intern), Dafni, T. (Ekstern), Decker, T. (Ekstern), Ferrer-Ribas, E. (Ekstern), Garcia, J. (Ekstern), Giomataris, I. (Ekstern), Garza, J. (Ekstern), Hailey, C. J. (Ekstern), Hill, R. (Ekstern), Iguaz, F. (Ekstern), Irastorza, I. (Ekstern), Jakobsen, A. (Intern), Luzon, G. (Ekstern), Mirallas, H. (Ekstern), Papaevangelou, T. (Ekstern), Pivovarov, M. (Ekstern), Ruz, J. (Ekstern), Vafeiadis, T. (Ekstern), Vogel, J. (Ekstern)

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