Joint DESY and University of Hamburg Accelerator Physics Seminar

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(16:00 in Room 459/30b)

Engineering Aspects of Microwave Axion Generation and Detection Experiments using RF Cavities

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Abstract

The detection or exclusion of the existence of axions in the micro-eV range belongs to the fundamental questions of modern physics. One of the techniques to carry out this experiment is the "light shining through the wall" method. In this case we have an axion generation process in a microwave cavity which is immersed in a strong DC magnetic field and nearby an axion detector using a second cavity, also in a magnetic field, which acts as a receiver at the same frequency. Obviously the RF leakage or simple electromagnetic crosstalk between both cavities must be extremely small (better than 300 dB) and well controlled during the complete duration of the experiment. In parallel a very high sensitivity for the narrowband signal to be detected is required. The latter can be implemented by using a phase locked tracking receiver method (GHz range) and we are aiming to obtain an effective signal bandwidth in the order of 1 μHz for about 2 weeks observation time. In this talk we discuss technological aspects (the box in a box method) to realize the above mentioned 300 dB RF-isolation. We need means to provide online evidence during the entire run of the experiment, that those requirements are really met. Optical fibers will be used for signal transmission as well as for the supply of DC power of low level microwave electronic components near the receiver cavity. In addition novel conceptual designs for using a higher order mode cavities to be installed in the bore of a LHC magnet are presented.

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