

The tunable microwave cavity for pilot axion experiment at IBS/CAPP

Friday 6 July 2018 20:15 (15 minutes)

A Pilot experiment of CULTASK (CAPP's Ultra Low Temperature Axion Search in Korea) started to take axion data in the frequency range between 2.45~2.75GHz with a specially designed microwave cavity. The conventional design, i.e., the open cylinder with two disk shaped endcaps, creates critical reduction on quality factor (Q factor) of the cavity due to the perpendicular crossing between the discontinuity of cavity and the current flow of TM₀₁₀ mode. We have fabricated the cavity by cutting the copper rod vertically and digging the inside of two halves of the cylinder. The Q factor measurements perfectly agree with the finite difference time domain (FDTD) simulation results whereas conventional horizontal cut cavities have shown near 10% degradation. We have tuned the resonant frequency of the cavity with ~ 1 kHz resolution by changing horizontal position of sapphire or copper rod which is controlled by Attocube piezoelectric actuators. The geometrical factor was more than 0.55 over all frequency range and the Q factor was more than 80,000 with copper rod and more than 100,000 with sapphire rod. I will present the details of the resonant cavity R&D and discuss the future plans.

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Session Classification: POSTER

Track Classification: Dark Matter Detection