## Abstract Submitted for the MAR14 Meeting of The American Physical Society

Discovery of higher order modes in a cylindrical reentrantring cavity resonator for high sensitivity displacement measurements<sup>1</sup> MICHAEL TOBAR, YAOHUI FAN, The University of Western Australia, ZHENGYU ZHANG, The University of Science and Technology of China, NATALIA CARVALHO, JEAN-MICHEL LE FLOCH, The University of Western Australia, QING SHAN, National University of Defense Technology — A microwave reentrant cavity transducer is a highly sensitive transducer, which has been developed in the past for many precision applications, including gravitational wave detection, high sensitivity optomechnics and investigating the dynamic Casimir effect. Such systems may be used for displacement measurements, sideband cooling, amplification of mechanical motion and investigating quantum behavior of mechanical resonators. The key component of the reentrant transducer is a narrow-gap superconducting reentrant cavity, which has achieve high displacement sensitivity and electrical Qfactor at low temperatures. Rigorous analysis of the properties of resonant modes in such a structure comprising of a post and ring is undertaken and verified experimentally. For the first time we show the existence of higher order reentrant cavity modes, with a significantly better displacement sensitivity compared to the common fundamental mode in a reentrant cylindrical cavity with just a single post. Thus, this type of cavity has the potential to operate as a highly sensitive transducer for a variety of precision measurement applications.

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Michael Tobar The University of Western Australia

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