

Abstract Submitted
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Direct Observation of X-ray Resonance Effects in Crystal Cavity Using Sub-meV Resolution Synchrotron Radiation¹ SHIH-LIN CHANG, National Tsing Hua University, YURIY P. STETSKO, MAU-TSU TANG, National Synchrotron Radiation Research Center (NSRRC), YEN-RU LEE, WEN-HSIEN SUN, HSUEH-HUNG WU, National Tsing Hua University, MAKINA YABASHI, SPring-8/JASRI, TETSUYA ISHIKAWA, SPring8/RIKEN Harima Institute, PHYSICS DEPARTMENT, NATIONAL TSING HUA UNIVERSITY TEAM, NATIONAL SYNCHROTRON RADIATION RESEARCH CENTER (NSRRC) TEAM, SPRING-8/JASRI TEAM, SPRING8/RIKEN HARIMA INSTITUTE TEAM — X-ray resonator, or cavity, has long been proposed and considered as a first step in realizing an X-ray laser for more than three decades. Attempt to realize the resonance in a crystal cavity has been pursued from time to time but with limited success. The difficulty arises mainly from lack of a sufficient energy resolution of X-rays and of a small-gap crystal cavity. That is, the required temporal coherence is not retained. With a high energy resolution of $\Delta E=0.36$ meV at 14.438 keV of X-ray synchrotron radiation and crystal plates with 100~150 μm gaps prepared by the microelectronic lithography technique, here we report the realization of a Fabry-Perot resonator for hard X-rays. Interference fringes inside the total reflection range in angle scans and inside the energy gap in energy scans near and at the (12 4 0) reflection position for two- and eight-plate silicon crystal cavities are clearly observed. This finding suggests many fundamental investigations and applications in high-resolution X-ray optics.

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