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Single Crystal X-ray Spectropolarimeter for HED Plasmas[1]
MATTHEW WALLACE, SHOWERA HAQUE, PAUL NEILL, University of Nevada, Reno, ALAN KASTENGREN, Argonne National Laboratory , NINO PEREIRA, Ecopulse, Inc. , RADU PRESURA, Voss Scientific — When energetic electrons in a plasma have a preferred direction the resulting X-rays can be polarized. This makes plasma X-ray polarization spectroscopy, spectropolarimetry, a useful way to reveal information about the anisotropy of the electron velocity distribution. X-ray spectropolarimetry has been used for characterizing the anisotropy of space and laboratory plasmas environments. The spectrum's polarization, typically measured with two crystals both at a 45 degree Bragg angle or one on successive shots, can now be determined in a new way using one crystal. Crystals with hexagonal symmetry present pairs of internal planes that diffract incident X-rays in two directions that are perpendicular to each other and the incident ray. The diffracted components are linearly polarized perpendicularly to each other. The polarization splitting properties of quartz crystals were confirmed with linearly polarized X-rays from the Advanced Photon Source. A Y-cut crystal that splits polarization with [11-20] planes at 7.15 keV was among those tested. An X-cut crystal with [10-10] polarization splitting planes was then tested on Al wire array z-pinches at UNR. We will present the use and development of a single crystal X-ray polarimeter for the characterization of anisotropy in HED plasmas.

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