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Analyzing x-ray hotspot images with Ince-Gaussian modes[1]
MICHAEL KRUSE, JOHN FIELD, RYAN NORA, ROBIN BENEDETTI, SHAHAB KHAN, TAMMY MA, LUC PETERSON, BRIAN SPEARS, Lawrence Livermore Natl Lab — X-ray images at the National Ignition Facility (NIF) provide important metrics regarding the shape of the hotspot along a given line-of-sight. The 17% contour from peak brightness is usually used to infer the size of the hotspot as well as determine shape perturbations quantified through the Legendre coefficients P_2 and P_4. Unfortunately features that lie inside the contour such as those that could arise from tent or fill-tube perturbations are not easily captured. An analysis that takes into account the two-dimensional nature of the x-ray image is desirable. Ince-Gaussian modes (for short: Ince) offer such an analysis and could provide a new way to encode and understand the images recorded at NIF. The Ince modes are the solutions to the paraxial wave equation expressed in elliptical coordinates and thus form an orthonormal basis. Due to their elliptical nature they are suitable for decomposing images that have a non-zero P_2 or P_4 coefficient. We show that the Ince modes can be used to uncover structure that is missed by the contour analysis and how the modes aid in compressing images produced in large ensemble calculations. Finally a comparison is made to the Zernike modes which form an orthonormal basis on a circular disk.

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