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Continuum Model for Chaotic Pattern Dynamics on Au Surfaces Sputtered by Focused Ion Beam KEVIN MITCHELL, UBC Dept of Phys. & Astro., ARVIN YAZDI, UBC Dept. of Phys. & Astro., TOM TIEDJE, UBC Dept of Phys. & Astro. / Dept. Elec. & Comp. Eng. — Under bombardment by a rastered 30keV Ga^+ ion beam, a flat Au surface is found to exhibit the well known sputter ripple instability with a characteristic lateral length scale on the order of 100nm and an RMS saturation height on the order of 10nm. Using *in situ* SEM imaging, we are able observe the dynamics of these ripples as they form and evolve. Accurate topography data is also gathered using *ex situ* AFM. These experimental data are compared to 2D numerical solutions of the dimensionless partial differential equation $\partial_t h = -\nabla^2 h - \nabla^4 h - \alpha |\nabla h|^2 + \beta \nabla^2 |\nabla h|$, which capture the essential features of the sputter ripples. A semi-implicit spectral method is used to solve the equation on a 128×128 grid covering a $20(2\pi) \times 20(2\pi)$ periodic domain. A length scale near $2\pi\sqrt{2}$, consistent with linearized stability is observed, as is a saturation height of order 1 when the constraint $\alpha^2 + \beta^2 = 1$ is enforced. Interestingly, the ratio α/β is found to control the timescale of the chaotic post-saturation dynamics in addition to fine tuning the length and height scales.

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