Dynamic Modes Maps of Incommensurate Superstructures within the Surface Energy Field

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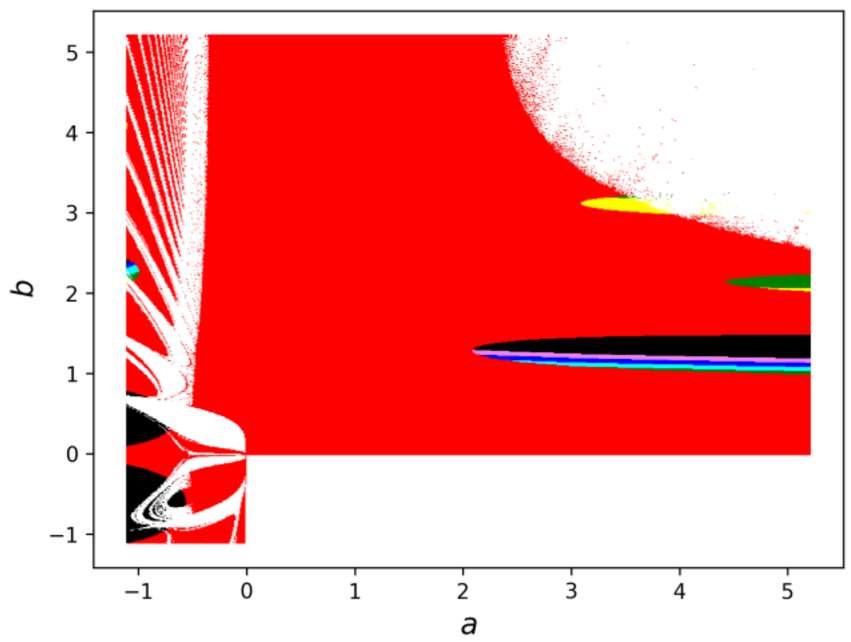
Introduction

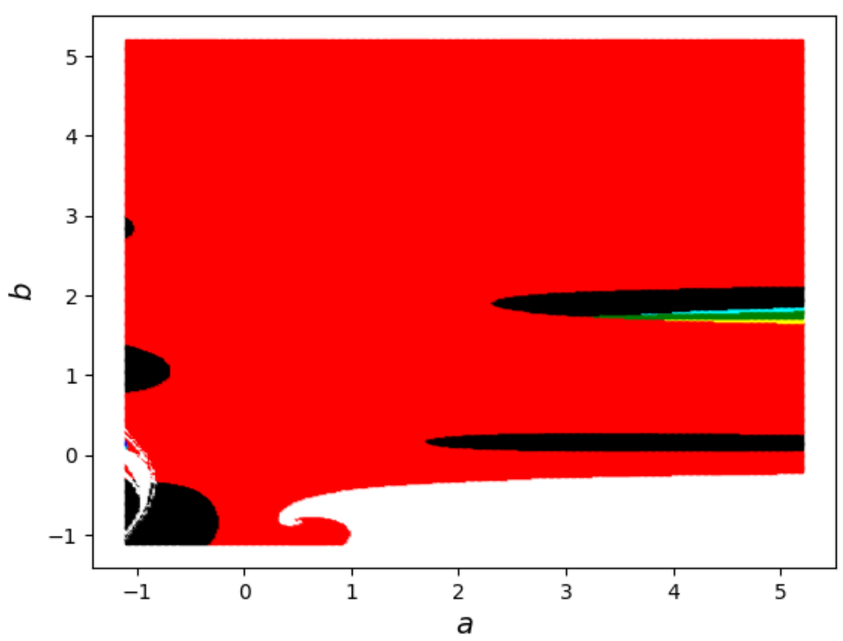
Dynamic mode maps are informative tools for studying the modes of complex systems. When such systems are characterized by a stochastic mode of its dynamics, the dynamic mode maps are described by periodicities with different periods. Examples of such systems include crystals of the A_2BX_4 group with the chemical formula $[N(CH_3)_4]_2MeCl_4$, where Me=Co; Zn; Mn; Fe; Ni; Cu, which undergo complex phase transitions, including incommensurate phases. In these crystals, the incommensurate superstructure undergoes several modes upon cooling, including sinusoidal, solitonic, and stochastic modes.

Results and Discussion

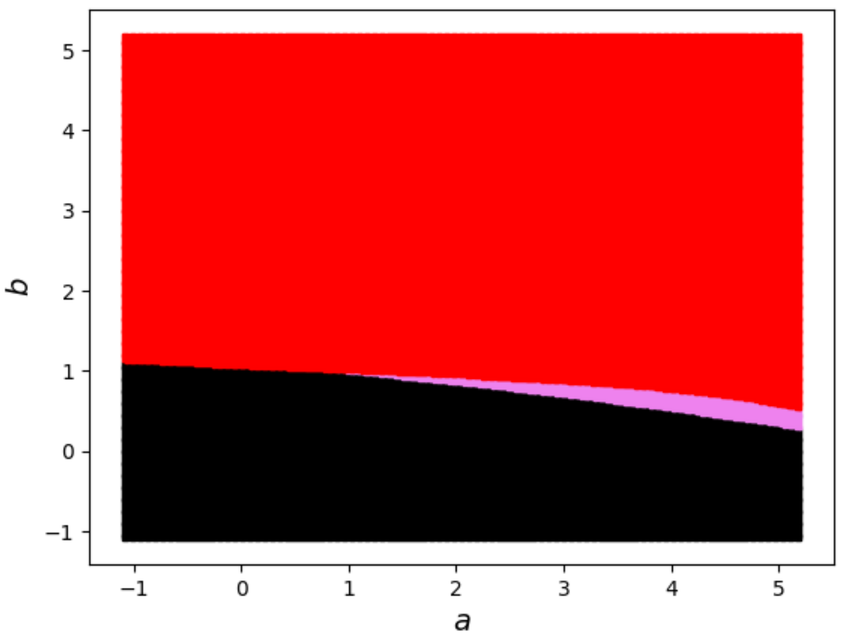
The influence of surface energy on the incommensurate superstructure leads to a transition from an inhomogeneous state to a homogeneous state, accompanied by the appearance of commensurate long-periodic phases.



a) E=0



b) *E*=0.7



c) E=7.0

Fig.1. *Figure 1. Dynamic modes map in the a and b axes, where* ***a=K*** *is the value of the anisotropic interaction parameter described by the Dzialoszynski invariant,* ***b=T*** *is the value of the long-range interaction parameter of the system on the surface energy at n = 4 (red -1; orange -2; yellow-3; green -4; cyan -5; blue -6; violet -7; black - all other periodicities).*

The dynamic mode maps of this superstructure under the influence of surface energy were studied to confirm such behavior of the incommensurate superstructure within the surface energy field. From the obtained dynamic mode maps (Figure 1), it can be observed that the system exhibits a broad spectrum of possible periodicities in the absence of surface energy influence on the incommensurate superstructure. The influence of surface energy on the incommensurate superstructure leads to a narrowing and further contraction of the range of some observed periodicities while expanding the scope of others.

Conclusion

Therefore, the obtained results regarding the analysis of dynamic mode maps of the incommensurate superstructure under the influence of surface energy confirm the existence of the aforementioned dynamics of the incommensurate superstructure under the surface energy influence.