Contribution ID: **39** Contribution code: **S2 Condensed Matter Physics** Type: **Poster Presentation**

Effects of Temperature on Persistence Probabilities in Molecular Beam Epitaxy Model

Persistence probability is an interesting quantity used in the study of stochastic processes. According to J. Krug [1], persistence probability of height fluctuation is the probability that the height fluctuation does not return to its initial value throughout a time interval. The persistence probability exhibits power law decay with time with the exponent θ. In this work, we use a numerical simulation approach to investigate the persistence probability in Molecular-Beam Epitaxy (MBE) model which is associated with Molecular-Beam Epitaxy technique [2-4]. In the first half of this work, we study the effects of temperature on the growth exponent (β) and persistence exponent (θ). For the relatively low temperature (associated with nearest neighboring site diffusion length), we obtain $\beta \approx 0.16$ and dynamic exponent (z) ≈ 3.30. When the temperature increases, β decreases while θ increases. In the second half, we study the dependence of persistence probability on initial height fluctuation (h_0), system size (L), and discrete sampling time (δt) and investigate the scaling relation. Our findings show that the steady state persistence probabilities are a function of three parameters: $f(t/L^z, t/L^z, |h_0|/w_{sat})$ which is the same as what was previously found in linear growth models [5]. We also find that the positive persistence probability of negative initial height does not show power law decay unless the initial height is much greater than the saturated interface width (w_{sat}), similar to the Das Sarma–Tamborenea model in [6].

References
[1] Krug, J., et al. "Persistence exponents for fluctuating interfaces." Physical Review E 56.3 (1997): 2702.
[2] Barabási, A-L., and Harry Eugene Stanley. Fractal concepts in surface growth. Cambridge university press, 1995.
[3] Chanyawadee, Soontorn. Modeling of molecular beam epitaxy growth under ehrlich-schwoebel potential barrier effects. Diss. Chulalongkorn University, 2004.
[4] Potepanit, Somjintana. Effects of annealing process on film surfaces grown by molecular beam epitaxy growth model with arrhenius law. Diss. Chulalongkorn University, 2012.
[5] Chanphana, R., P. Chatraphorn, and C. Dasgupta. "Effects of initial height on the steady-state persistence probability of linear growth models." Physical Review E 88.6 (2013): 062402.
[6] Chanphana, R., and P. Chatraphorn. "Persistence probabilities of height fluctuation in thin film growth of the Das Sarma–Tamborenea model." Indian Journal of Physics 95.1 (2021): 187-193.vx

Author: SANSEEHA, Pipitton

Co-authors: CHATRAPHORN, Patcha; CHANPHANA, Rangsima (Chulalongkorn University)

Presenter: SANSEEHA, Pipitton

Session Classification: Poster: S2 Condensed Matter Physics

Track Classification: Condensed Matter Physics