Thesis Title

by

Author Name

A thesis submitted in partial fulfillment for the
degree of Doctor of Philosophy

in the
Faculty Name
Department or School Name

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Declaration of Authorship

I, AUTHOR NAME, declare that this thesis titled, 'THESIS TITLE' and the work presented in it are my own. I confirm that:

- This work was done wholly or mainly while in candidature for a research degree at this University.

- Where any part of this thesis has previously been submitted for a degree or any other qualification at this University or any other institution, this has been clearly stated.

- Where I have consulted the published work of others, this is always clearly attributed.

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- I have acknowledged all main sources of help.

- Where the thesis is based on work done by myself jointly with others, I have made clear exactly what was done by others and what I have contributed myself.

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Date:

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"Write a funny quote here."

If the quote is taken from someone, their name goes here

UNIVERSITY NAME (IN BLOCK CAPITALS)

Abstract

Faculty Name

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Doctor of Philosophy

by Author Name

The Thesis Abstract is written here (and usually kept to just this page). The page is kept centered vertically so can expand into the blank space above the title too...

Acknowledgements

The acknowledgements and the people to thank go here, don't forget to include your project advisor...

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Abbreviations

LAH   **L**ist **A**bbreviations **H**ere

Physical Constants

Speed of Light $\quad c \quad = \quad 2.997\ 924\ 58 \times 10^8$ ms$^{-\text{S}}$ (exact)

Symbols

a	distance	m
P	power	W (Js^{-1})
ω	angular frequency	rads^{-1}

For/Dedicated to/To my. . .

Chapter 1

Results

Simulations were peformed on system sizes $L = 40, 48, 64, 80, 104, 128$ with the λs taken from zero to one in steps of 0.2 and also 1.5 where λ_x and λ_y had the same magnitude and the same or opposite signs.

1.1   Linear Case

Figure. 1.1 overlays the Binder cumulant evolution for different sizes in the linear ($\lambda_x = \lambda_y = 0$) case which corresponds to the XY model. Figure. 1.2 does the same but plotted with respect to $t/L^2 \log t$ where the collapse is expected. As is clear, this reobtains the result from XX while using Stochastic evolution rather than Monte Carlo and provides confidence in the results for the non-linear cases. The collapse is not perfect: in Figure. 1.3, which shows the Binder cumulant at the mid point of its evolution as a function of the number of realisations for all the system sizes, the

1.2   Anistropic Case

For non-zero λs, when $\lambda_x = -\lambda_y$, we expect to obtain the same result as the XY model. Figures. XX to XX show the Binder cumulant plotted as a function of t and also $t/L^2 \log t$ for several values of increasing λ_x. Although the collapse is not as tight as for the linear case, it clearly still occurs, confirming the expectation. Due to the errors on the Binder cumulant, which are shown in Figures XX to XX, is not clear whether further realisations are necessary to tighten the collapse further, or if the dynamical exponent growth rate $(t/\log t)^{1/2}$ is simply not as good an approximation as in the linear case.
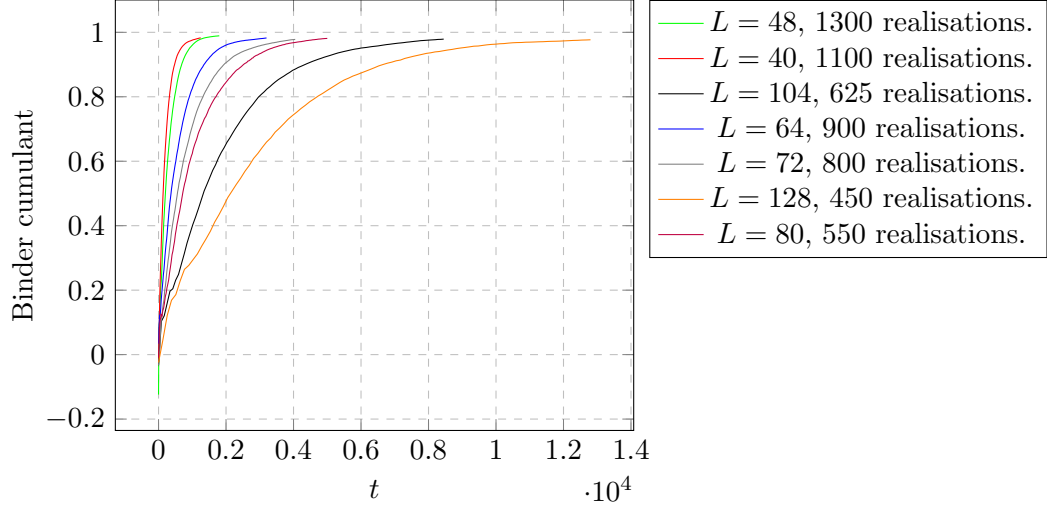
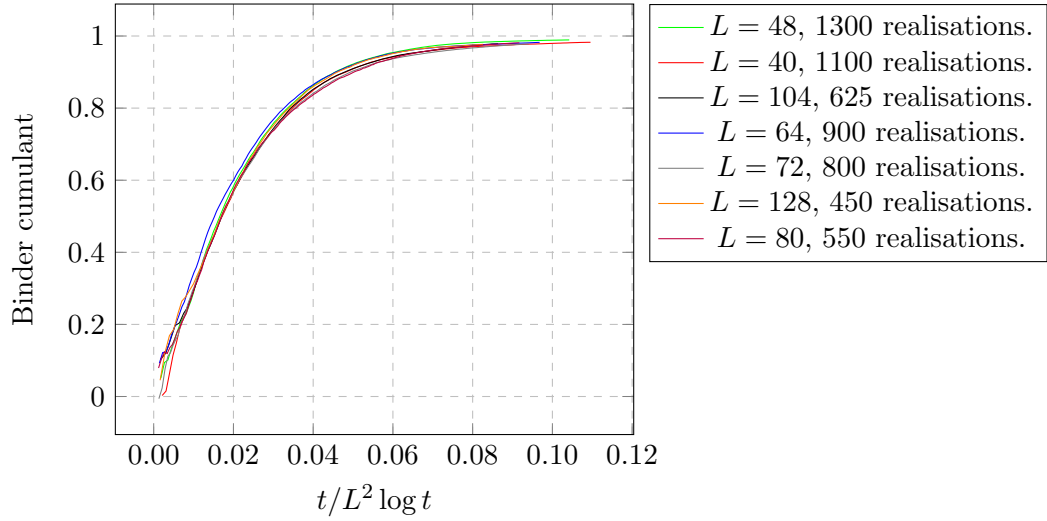FIGURE 1.1: The Binder cumulant for different sizes with $\lambda_x = \lambda_y = 0$.

FIGURE 1.2: The Binder cumulant as a function of $t/L^2 \log t$ for different sizes with $\lambda_x = \lambda_y = 0$.

There are clear differences here, however, as the convergence to near one occurs more rapidly on increasing λ. This is corroborated by fig XX which shows that the gradient in $\log n_v$ where n_v is then number of vortex pairs as a function of $\log(t/\log t)$ decreases on increasing λ, indicating a faster transition to the ordered phase.
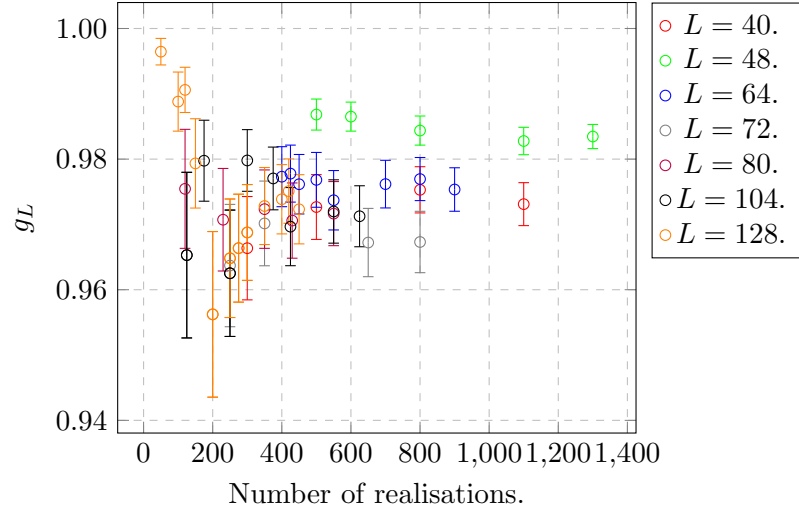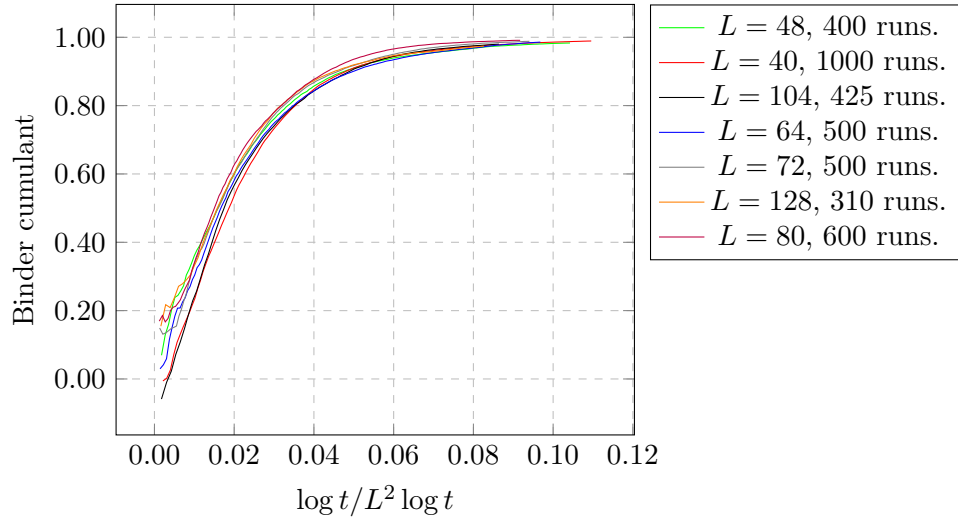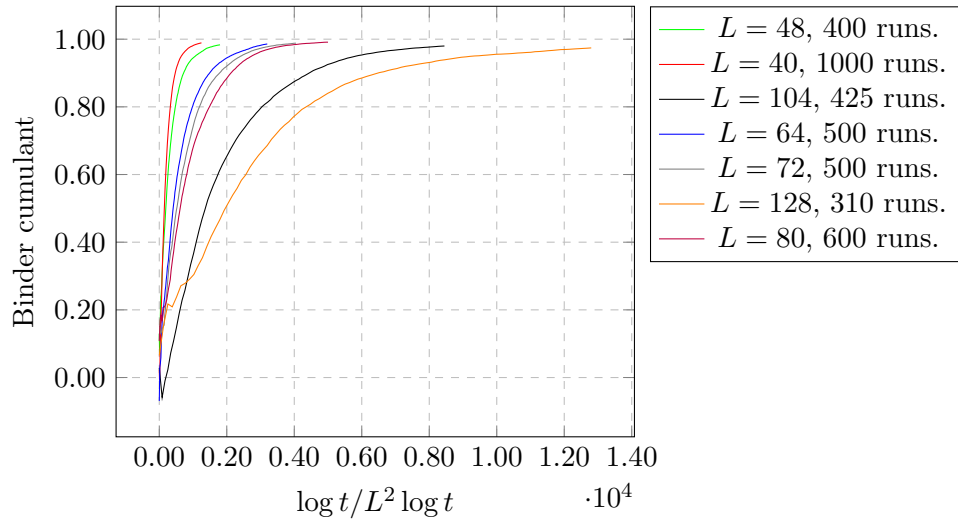
FIGURE 1.3: The uncertainty in the Binder cumulant at the mid point of the simulation as a function of the number of realisations for all system sizes.
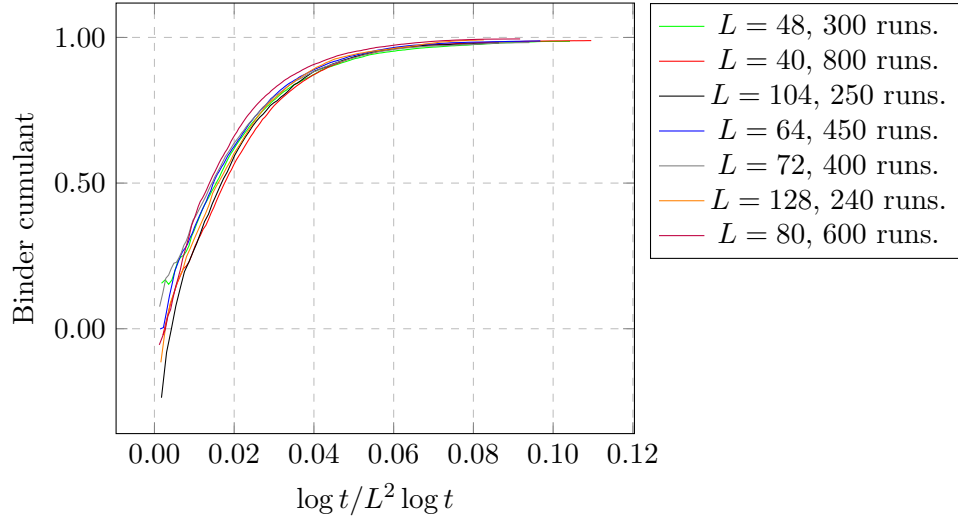
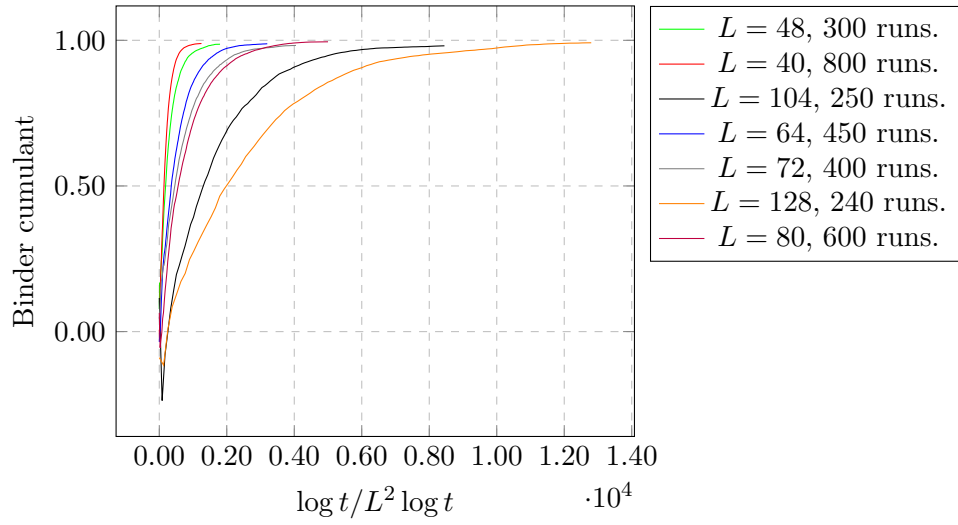Binder cumulant for $\lambda_x= 0.2$, $\lambda_y=-0.2$, $c_L=0.2$.

Binder cumulant for $\lambda_x= 0.2$, $\lambda_y=-0.2$, $c_L=0.2$.

Binder cumulant for $\lambda_x= 0.4$, λ_y=-0.4, c_L=0.2.

Binder cumulant for $\lambda_x= 0.4$, λ_y=-0.4, c_L=0.2.

Binder cumulant for $\lambda_x= 0.6$, λ_y=-0.6, c_L=0.2.

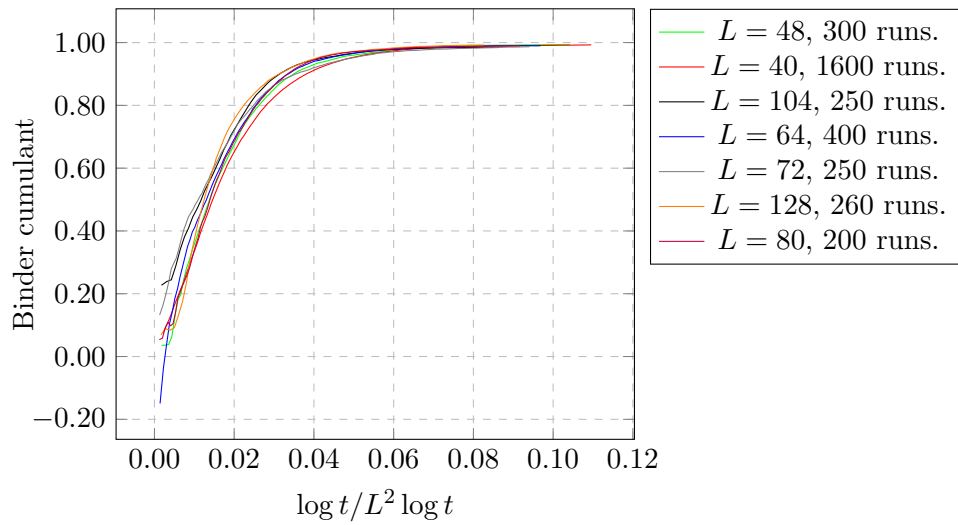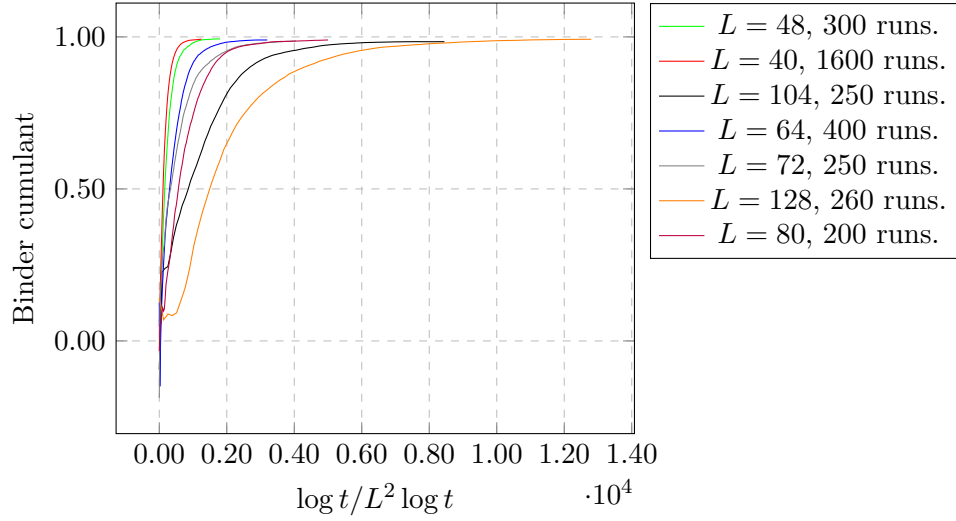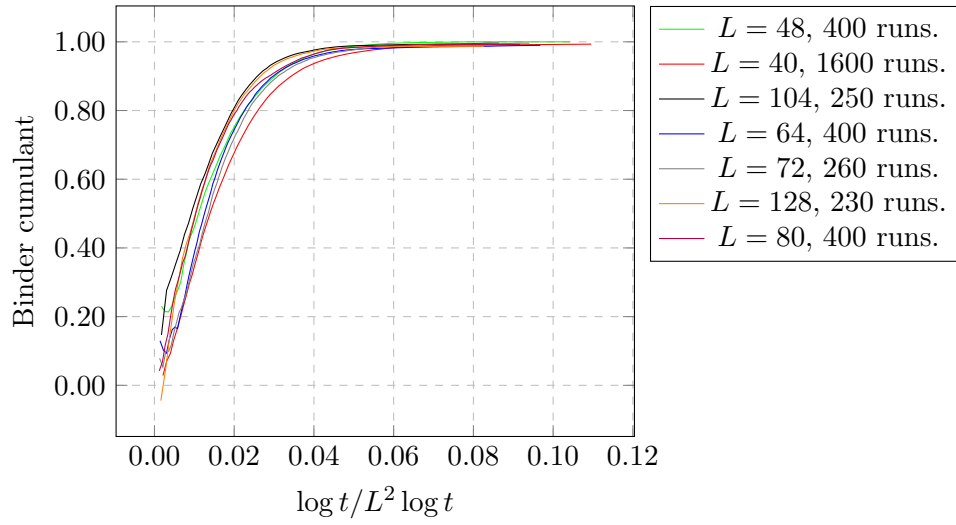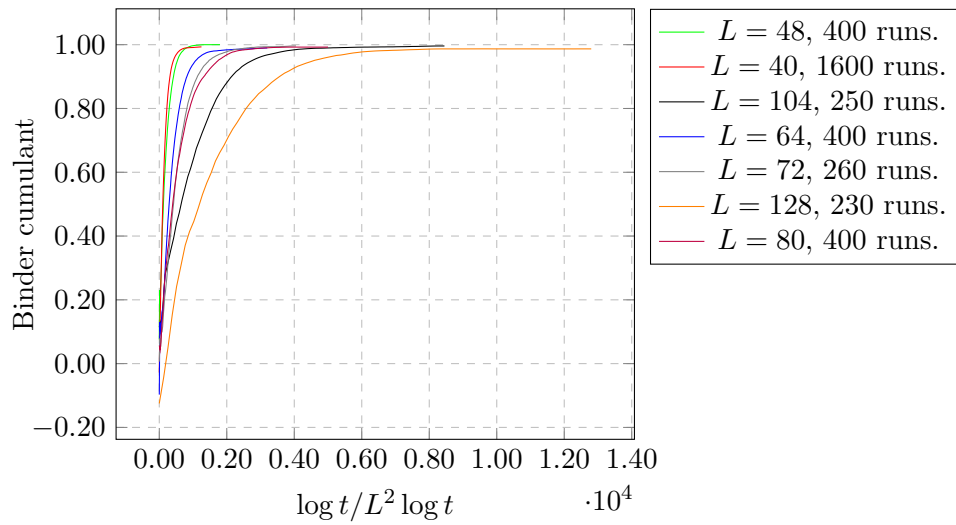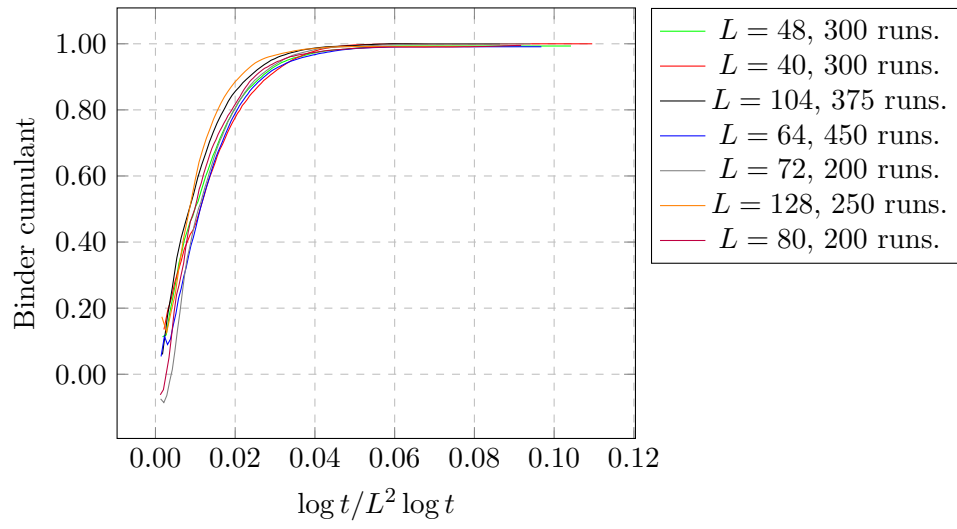Binder cumulant for λ_x= 0.6, λ_y=-0.6, c_L=0.2.

Binder cumulant for $\lambda_x = 0.8$, $\lambda_y = -0.8$, c_L=0.2.

Binder cumulant for $\lambda_x = 0.8$, $\lambda_y = -0.8$, c_L=0.2.

Binder cumulant for $\lambda_x= 1$, λ_y=-1, c_L=0.2.

Appendix A

An Appendix

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