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Large deviations principle for the invariant measures of the 2D stochastic Navier–Stokes equations on a torus

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**LARGE DEVIATIONS PRINCIPLE FOR THE INVARIANT
MEASURES OF THE 2D STOCHASTIC NAVIER-STOKES
EQUATIONS ON A TORUS**

Z. BRZEŹNIAK AND S. CERRAI

ABSTRACT. We prove here the validity of a large deviation principle for the family of invariant measures associated to a two dimensional Navier-Stokes equation on a torus, perturbed by a smooth additive noise.

CONTENTS

1. Introduction	1
Acknowledgments	3
2. Notation and preliminaries	4
3. The skeleton equation	7
4. LDP for stochastic NSEs on a 2-D torus	10
5. Exponential estimates	14
6. Lower bounds	16
7. Upper bounds	19
8. Proof of Lemmata 7.2 and 7.3	22
Appendix A. Behavior of the solutions of the Navier-Stokes equations for large negative times	26
References	31

1. INTRODUCTION

In the present paper we are dealing with 2-D Navier Stokes equations with periodic boundary conditions, perturbed by a small additive noise. These boundary conditions are usually realized by considering the problem on a two-dimensional torus \mathbb{T}^2 , see Section 2 for more details. To fix readers attention, let us write down these equations in a functional form, as

$$du(t) + Au(t) dt + B(u(t), u(t)) dt = \sqrt{\varepsilon} dw(t), \quad u(0) = u_0, \quad (1.1)$$

for $0 < \varepsilon \ll 1$.

Full definitions of the symbols involved can be found later in Section 2, but, for the time being, let us recall that A is the Stokes operator, equal, roughly speaking, to the Laplace operator (acting on vector fields) composed with the Leray-Helmoltz projection P , defined on the space of zero mean and square integrable vector fields

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