

# Preface

The main goal of this book is to construct a theory of weights for the log crystalline cohomologies of families of open smooth varieties in characteristic  $p > 0$ . This is a  $p$ -adic analogue of the theory of the mixed Hodge structure on the cohomologies of open smooth varieties over  $\mathbb{C}$  developed by Deligne in [23]. We also prove the fundamental properties of the weight-filtered log crystalline cohomologies such as the  $p$ -adic purity, the functoriality, the weight-filtered base change theorem, the weight-filtered Künneth formula, the convergence of the weight filtration, the weight-filtered Poincaré duality and the  $E_2$ -degeneration of  $p$ -adic weight spectral sequences. One can regard some of these results as the logarithmic and weight-filtered version of the corresponding results of Berthelot in [3] and K. Kato in [54].

Following the suggestion of one of the referees, we have decided to state some theorems on the weight filtration and the slope filtration on the rigid cohomology of separated schemes of finite type over a perfect field of characteristic  $p > 0$ . This is a  $p$ -adic analogue of the mixed Hodge structure on the cohomologies of separated schemes of finite type over  $\mathbb{C}$  developed by Deligne in [24]. The detailed proof for them is given in another book [70] by the first-named author.

We have to assume that the reader is familiar with the basic premises and properties of log schemes ([54], [55]) and (log) crystalline cohomologies ([3], [11], [54]). We hope that the findings in this book will serve as a role as a first step to understanding the rich structures which  $p$ -adic cohomology theory should have.

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*Yukiyoshi Nakkajima*  
*Atsushi Shiho*



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Nakkajima, Y.; Shiho, A.

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