

Preface

In the early years of the 1980s, while I was visiting the Institute for Advanced Study (IAS) at Princeton as a postdoctoral member, I got a fascinating view, studying congruence modulo a prime among elliptic modular forms, that an automorphic L -function of a given algebraic group G should have a canonical p -adic counterpart of *several* variables. I immediately decided to find out the reason behind this phenomenon and to develop the theory of ordinary p -adic automorphic forms, allocating 10 to 15 years from that point, putting off the intended arithmetic study of Shimura varieties via L -functions and Eisenstein series (for which I visited IAS). Although it took more than 15 years, we now know (at least conjecturally) the exact number of variables for a given G , and it has been shown that this is a universal phenomenon valid for holomorphic automorphic forms on Shimura varieties and also for more general (nonholomorphic) cohomological automorphic forms on automorphic manifolds (in a markedly different way).

When I was asked to give a series of lectures in the Automorphic Semester in the year 2000 at the Emile Borel Center (Centre Emile Borel) at the Poincaré Institute in Paris, I chose to give an exposition of the theory of p -adic (ordinary) families of such automorphic forms p -adically depending on their weights, and this book is the outgrowth of the lectures given there.

In addition to an exposition of p -adic deformation theory of automorphic forms, I decided to give a comprehensive account of the construction of Shimura varieties (carrying a canonical family of abelian varieties) and Shimura's reciprocity laws characterizing them. Although this part is essentially expository, some new results of the author are included:

1. a (partially) new proof of some reciprocity laws of Shimura varieties;
2. irreducibility of the Igusa tower over unitary Shimura varieties;
3. a construction of invertible sheaves on Hilbert modular varieties that gives optimal p -integrality on Hilbert modular forms.

It is my hope that this book is useful to graduate students and researchers entering this area of research.

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