Some Fruits of Genius:
Lars Onsager and the Ising Model

Michael E. Fisher

Institute for Physical Science and Technology

University of Maryland, USA

xpectnil@ipst.umd.edu

The major work of Lars Onsager, the great Norwegian-American theorist, in solving exactly for a variety of properties of the two-dimensional Ising model in the period 1942-49 will be reviewed. The Ising model is the most basic statistical mechanical model of a ferromagnet and describes the Curie point; but it also provides great insight as a model of a fluid, notwithstanding its discrete lattice structure. The focus will be on the many explicit results obtained and how, from these seeds, grew major theoretical fruits: nonclassical critical exponents, the scaling of bulk thermodynamic and correlation functions near criticality, the exploitation of series expansions and finite-size scaling theory, interfacial and boundary tensions and, especially in the hands of D.B. Abraham, the divergent fluctuations of interfaces and the microscopic verification of contact-angle phenomenology. The divergence of interfacial thickness, although it should be only logarithmic in d=3 spatial dimensions, has implications for the validity of the standard continuum models of fluids.