Title : Phase-field modeling of solidification microstructures

by

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The solidification of liquid melts leads to the spontaneous emergence of complex microstructures, such as dendrites, cells, two-phase composites and two-phase fingers. They are fascinating examples for pattern formation out of equilibrium, and are also important for the properties of the final solid material. In recent years, the phase-field method has become the method of choice for modeling and simulations of such microstructures. The two main reasons are that interfacial anisotropy can easily be incorporated in phase-field models, and that methods have been developed for the upscaling of the interface thickness. This leads to an enormous reduction in computation times and makes a direct comparison of simulations and experiments possible. I will comment on the construction of such models for pure substances, binary one-phase and two-phase alloys, and for polycrystals, and then present applications to dendritic, cellular and eutectic patterns.