Title: On Total variation flow type equations

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Abstract:
The classical total variation flow is the L^2 gradient flow of the total variation. The variation of a function is a singular energy at the place where the slope of the function equals zero. Because of this structure, its gradient flow is actually nonlocal in the sense that the speed of slope zero part (called a facet) is not determined by infinitesimal quantity. Thus, the definition of a solution itself is a nontrivial issue even for the classical total variation flow.
Recently, there need to study various types of such equations. A list of examples includes the total variation map flow as well as the classical total variation flow and its fourth order variation in image denoising, crystalline mean curvature flow or fourth order total variation flow of exponential type in crystal growth problems which are special important problems in materials science.
In this talk, we survey recent progress on these equations with special emphasis on a crystalline mean curvature flow whose solvability was left open more than ten years. We shall give a global-in-time unique solvability in the level-set sense. This last well-posedness result is based on my joint work with N. Požár (Kanazawa University) whose basic idea depends on my early joint work with M.-H. Giga (The University of Tokyo) and N. Požár.