New paradigms for asteroid formation

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Asteroids provide key evidence about the formation of planetesimals in the solar system. Traditionally thought to form bottom-up by accretion of a population of km-scale planetesimals, new models challenge this idea by showing that asteroids of sizes from 100 to 1000 km can form directly from gravitational collapse of overdense filaments of cm-sized particles. Particles concentrate passively in pressure bumps or actively through streaming instabilities developing in the coupled flow of gas and particles. In this chapter we review new paradigms for asteroid formation and compare critically against the observed properties of the asteroid belt as well as meteoritical evidence. We highlight several properties of asteroids and meteorite parent bodies which may be explained within an expanded asteroid-formation theory framework.