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Accretion of planetesimals and rocky planets in protoplanetary discs

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Planets grow within protoplanetary discs of gas and dust orbiting young stars. Terrestrial planets have traditionally been modelled to form by collisions between planetesimals and protoplanets taking place mostly after the dissipation of the protoplanetary disc, on time-scales of 30-100 million years. I compare here this traditional view with a new theoretical model where terrestrial planets grow instead by accreting small pebbles in the protoplanetary disc within 3-5 million years. In this view, volatiles are delivered as rims of ice and organics on millimetre-sized pebbles, in contrast to the prevailing model that postulates that volatiles were primarily delivered via asteroidal impacts. I will discuss how volatile delivery via pebbles allows a direct calculation of the composition of the atmospheres of rocky planets with little or no contribution from stochastic impacts with volatile-rich asteroids. Finally, I will demonstrate why giants planets have only limited ability to block the flow of pebbles from the outer regions of the protoplanetary disc and how this implies that rocky planets form with a significant fraction of material from the outer protoplanetary disc.