

Planetary Spin Rotation due to Pebble Accretion and Pebble Impact Velocity

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One possible scenario for the planet formation is pebble accretion. Here we investigate the spin rotation rate of a planet under the effect of pebble accretion. The impact velocity will be different from that of the planetesimal accretion model and the surface temperature may change from that of planetesimal accretion model. As the first step, here we calculate the impact velocity of the pebbles by carrying out large number of 3-body simulations. We also simulated the cases with the atmosphere surrounding the protoplanet. In such cases, the results drastically changed from that of the cases without atmosphere. Our results show that the rotation rate of Mars may be able to be explained by pebble accretion, and the impact velocity of the pebbles onto the Earth may reach the terminal velocity resulting in significantly different surface temperature from that of the planetesimal accretion model. Hence, pebble accretion may be able to explain some of the feature of Earth and Mars that could not be explained by planetesimal accretion model. Some of our results highly depends on the atmosphere model. Inclusion of more sophisticated model is left for future study.