The Inversion of the Real Kinematic Properties of Coronal Mass Ejections by Forward Modeling

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The kinematic properties of coronal mass ejections (CMEs) suffer from the projection effects, and it is expected that the real velocity should be larger and the real angular width should be smaller than the apparent values. Several attempts have been tried to correct the projection effects, which however led to a too large average velocity probably due to the biased choice of the CME events. In order to estimate the overall influence of the projection effects on the kinematic properties of the CMEs, we perform a forward modeling of the real distributions of the CME properties, such as the velocity, the angular width, and the latitude, by requiring their projected distributions to best match the observations. Such a matching is conducted by Monte Carlo simulations. According to the derived real distributions, it is found that (1) the average real velocity of all non-full-halo CMEs is about 514 km s^{-1}, and the average real angular width is about 33°, in contrast to the corresponding apparent values of 418 km s^{-1} and 42.7° in observations; (2) For the CMEs with the angular width in the range of $20^\circ- 120^\circ$, the average real velocity is 510 km s^{-1} and the average real angular width is 43.4°, in contrast to the corresponding apparent values of 392 km s^{-1} and 52° in observations.

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