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Dynamics of Solar Coronal Mass Ejections: Theory and New SECCHI Observation JAMES CHEN, Naval Research Laboratory, VALBONA KUNKEL, George Mason University — The physical mechanisms of coronal mass ejections (CMEs) and flares have been an important open question in solar and by implication stellar physics. The physical connections between CMEs and these phenomena have also been a major question. The new SECCHI observations represent unprecedented opportunities to test and establish new understanding of CME physics both closer to and farther away from the Sun than was previously possible. In this paper, I will discuss new results from recent applications of a theoretical flux-rope model of CMEs (Chen JGR, 1996) to several CMEs and their dynamics observed to about 100 Rs (1/2 AU) by SECCHI. Forces acting on these CMEs are found to be dominated by the Lorentz hoop force in the inner corona and by the competition of the hoop force and retarding drag force in the outer corona and heliosphere. It is shown that the erupting flux-rope model governed by these forces is able to fit the observed CME trajectories throughout the SECCHI field of view out to approximately 1/2 AU, indicating that the model correctly captures the basic physics, i.e., forces and magnetic geometry, of acceleration and propagation of CMEs. It is also shown that the duration of the poloidal flux injection function chosen to fit the CME trajectory closely match the duration of the observed GOES X-ray light curves for both short-duration and long-duration flares.

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