Abstract Submitted
for the APR20 Meeting of
The American Physical Society

Electrodynamic friction of a charged particle passing a conducting plate[1] XIN GUO, KIMBALL MILTON, YANG LI, Univ of Oklahoma, GERARD KENNEDY, Univ of Southampton — We calculate the friction that a charged particle will experience due to the electromagnetic interaction with a dissipative metal surface. In our calculation, a simple Drude model with a damping parameter β is used to describe the metal. Even though the problem entirely lies within the realm of classical electrodynamics, we found some very surprising features of the friction force experienced by the charged particle. First, instead of increasing monotonically with velocity, the friction reaches its maximum at an intermediate velocity, less than the speed of light. Second, the friction appears to be finite even when the damping parameter β approaches zero. Since any real metal have some damping according to the Kramers-Kronig relation to respect causality, this electromagnetic friction should be inevitable regardless of the type of metal involved. As a matter of fact, at a high enough velocity, the friction is even greater for metal which has a smaller β. Further, we found the magnitude of the friction is comparable to the corresponding Coloumb force at a distance of 100 nm. Therefore we expect this friction should be easily observed experimentally.

[1]This work was supported in part by a grant from the US National Science Foundation, grant number 1707511.

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Date submitted: 10 Jan 2020 Electronic form version 1.4